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ALGAE AQUAE DULCIS
INDIAE ORIENTALIS.

THE

FRESH-WATER ALGAE

(PRINCIPALLY DESMIDIEAE)

OF

EAST INDIA

BY

WILLIAM BARWELL TURNER.

WITH 23 PLATES.

PRESENTED TO THE ROYAL SWEDISH ACADEMY OF SCIENCES APRIL 13, 1892.

STOCKHOLM, 1892.
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER.

FORE-WORD.

Whilst pursuing my studies on the Desmidieæ in 1882—3 I received each year from Mr. J. SUTHERLAND, then travelling in India, two small bottles containing Algæ, collected in Central and Northern India — the exact localities not being clearly stated. Among the Algæ were many Desmidieæ, some being apparently new.

In determining these in 1883—4 I had recourse to the only memoir upon the Indian Desmidieæ, that of Dr. G. C. WALLICH, F. L. S. ('Descriptions of Desmidiaceæ from Lower Bengal', in the Annals and Mag. Nat. Hist. vol. V, ser. 3, pp. 184, 273, 1860), but that failed to assist me very much, as the memoir itself had been only partially proceeded with.

However, in 1884 I communicated with Dr. WALLICH, from whom I received a most courteous reply containing a very kind offer to place the residue of his 1855 gatherings at my disposal; which offer was most gladly accepted by me. Learning, in the meanwhile, that Dr. W. had presented slides of Desmids, and also his original Mscr. and sketches, to the Royal Microscopical Society of London, I asked permission to examine them; and the Council of the Society (with Dr. WALLICH's assent) generously allowed me to have the Mscr. volume and slides for a considerable period, during which I took ample notes. When in 1884—5 I made my examination of the remnant of Dr. WALLICH's gathering (preserved in dilute spirit for 30 years!) I discovered that many forms existed therein not described in the Mscr., and I also found that Dr. W. had seen and noted, when in India, many plants unseen by me; hence this little memoir has attained larger proportions than I or Dr. WALLICH expected. In my own examination I made over 1,100 sketches before I attempted any analysis or description of the forms. The greater part of my own Mscr. was compiled, but not written in extenso, in 1885—6.

In 1889 a valued correspondent, Dr. G. VON LAGERHEIM (then at Freiburg in Breisgau, and now of the University of Quito, Ecuador), kindly sent me some specimens of Indian Utriculariæ — from the Riks-Museum, Stockholm. These yielded many interesting and novel plants, which form welcome additions to the list, and for which I beg to sincerely thank him.

In order that I might avoid prolixity and verbosity of description, of which I do not approve, I have herein abbreviated my remarks as much as possible, except in the case of sundry extracts from Dr. WALLICH's unfinished (and to many inaccessible!) memoir of 1860. The examination of Dr. WALLICH's Mscr. has been attended with some difficulty, from the fact of varying scales of measurement having been employed by him. I have omitted Bibliographical list, as it seems to me a waste of space; a large number of works and memoirs have, however, been consulted by me.

I here take the opportunity of cordially thanking all my courteous helpers, especially Dr. WALLICH for his great kindness and valued letters; and I must tender my grateful acknowledgement of assistance and kindly counsel received from my good friend Dr. OTTO NORDSTEDT, of Lund.

Leeds, 25 Feb. 1892.

INTRODUCTION.

The majority of the Algæ comprised in the subsequent pages of this memoir were obtained by Dr. **Wallich** in the year 1855 (from July to November inclusive) from the great coal-field of Bengal, in the district of Raneegunge, about 120 miles N.W. of Calcutta. The district was at that time the scene of the Sonthal insurrection, which troops were sent to quell; and Dr. **Wallich**, then Field-surgeon of the expeditionary forces, during the intervals of military duty, found time to collect and observe a large number of the local *Chlorophyllophyceæ*. It is to be regretted that my friend did not complete his description in the 'Annals', his graphic power being far greater than mine; but science certainly had considerable and highly important additions from him both in his home voyage and in his observations, as government naturalist and scientist to the North Atlantic Surveying vessel (H. M. S. Bulldog, under the command of Sir **Leopold Mac Clintock**, R.N.), which were afterwards published in the 'North Atlantic Sea-bed', and in over 40 other memoirs and papers!

I have been requested by many correspondents to quote freely from Dr. **Wallich's** own words, and this I have done wherever practicable, especially in *Streptonema* and *Onychonema*, two new genera of the 1860 memoir. The following graphic pictures are too good to be omitted:

(a) »As might be supposed from the cosmopolite nature of the Desmidiaceæ generally, a large proportion of the species referred to are identical with those already known to occur in Europe and America. Many however are new, and these certainly equal, if they do not surpass, any of the hitherte recorded forms in beauty and symmetry. Amongst the more common species a remarkable amount of *divergence* from the typical character is everywhere to be met with — a circumstance depending, no doubt, on those peculiarities of soil and climate which, in Lower Bengal, are so favourable to the exuberant and rapid development of the entire vegetable kingdom. Such peculiarities operate, however, on the more minute tribes in a special degree; for whilst the higher orders of plants are subject only to the regularly recurring changes of a tropical region, and undergo no abrupt or violent transitions as regards habitat, the humbler Algæ are borne abroad, during their sporangial state, to great distances, and into positions differing widely in nature from those wherein they were originally engendered. The liability to variation arising from this cause must necessarily be extreme; and, therefore, few situations could be found in which the limits attainable by specific divergence, as occurring in these organisms, could more easily and satisfactorily be determined.» Beng. Desm. p. 184.

(b) »It is almost impossible to arrive at a correct estimate of the outburst of fresh life to which microscopic forms are subject in such a climate, by any comparison with what is observable elsewhere. Immediately prior to the setting-in of the annual rains, the pools, swamps, water-courses, and even the majestic rivers, are well nigh dried up. The surface of the soil is parched into a layer of impalpable dust, and the remnants of all the minute tribes of plants are carried to and fro, by the slightest winds, amongst the dusty particles to which they themselves largely contribute. At this period the sporangial state is assumed both by the Desmidiaceæ and Diatomaceæ, and it may be regarded, therefore, as a species of hybernation, during which vitality is maintained under the minimum of the conditions (c) essential to its continuance, and without the interposition of which phase these organisms would become extinct. For upwards of two months the rains continue to fall incessantly. The whole country is flooded, and the rivers expand to the proportions of inland seas. It is useless, as yet, to search for the Desmidiaceæ. No sooner, however, have the rains and inundations subsided, than the mud-laden pools clear down, the magic influences of light and heat are permitted to operate, and in an incredibly brief period the surface, the bottom, and the body of the waters absolutely teem with the crowded masses of animal and vegetable life.» Beng. Desm. p. 185.

Concerning the first quotation (a), I would remark that for Dr. WALLICH's view there is much to be said, and in proof of his view I have myself observed considerable divergence in some forms (e. g. *Micrasterias Crux-meliteńsis*), but space did not permit of my figuring many, or entering into full detail concerning them. On the other hand many forms are absolutely identical with well known European ones, as the figures of WALLICH and myself prove. The subject is very debateable (Cfr ARCHER in Dub. Micr. Club. Trans. 1865, and WALLICH's letter to him on »variation»); still it must be admitted that Nature is so prolific in design that no two leaves upon a tree, no two Desmids, are *exactly* alike! If it be argued that, because we cannot absolutely *see* the effects of evolution, which is is ever-changing and unceasing, such effects are not existent, it is merely a *façon de parler* and no argument at all — and I cannot help but agree for the most part with WALLICH (in litt. ad ARCHER l. c.), »the law which it is assumed governs the limits of species is *no law*, but only a conditional direction, holding good only so long as the surrounding conditions continue the same», i. e. through the environment being the same through a *lengthened* period of time.

Upon the second paragraph I would observe (c) that the *lower* orders of plants seem endowed with peculiar properties of vitality and continuance under stress of climate, and WALLICH's remarks are continued, under the opposite extreme, in 'The Desmidieæ of Greenland' (Trans. Roy. Mic. Sci. p. 130, 1869,) the locality cited, Godhaab, being 64° N. Lat., and the pools frozen up for 8 months in the year. It is also significant that various Siberian forms observed by BOLDT have been found in Japan by ROY and BISSET, and by myself in the Indian material. The remarks of Dr. NORDSTEDT in Fr. Alg. N. Z. p. 5, 1888, are exceedingly interesting, as bearing upon the influence of region with reference to the lower Algæ.

There is another point of considerable influence upon the existence of Fresh-water Algæ, viz. the geological formation of the country; and it is a pity that the consequences of this influence have not received the attention they deserve. I had occasion (Naturalist, Feb. 1886) to refer to these details, and I find that Brebisson (Liste, p. 114) agrees with my views so far as a 'chalky' or cretaceous soil is concerned. Lower Bengal is partly alluvial, partly carboniferous, as regards the earth-strata.

Wallich states (p. 184 l. c.) that he had observed 140 species of Desmidieæ in the Raneegunge district: to which I may add that this number did not comprise very many of those I found in his Mscr., in which, including sundry doubtful species, there are icons of 238 Desmids. From results obtained by many observers, it appears that the value of gatherings is often in inverse ratio to the extent of country examined, e. g. A. W. Wills, Sutton Park, 89 sp.; idem, Capel Curig and Barmouth, 176 sp.; W. B. T., Strensall Common, near York, over 140 sp.; and Dr. Nordstedt informed me that, in one small Northern habitat, he had obtained 97 species; all being of Desmids. In Mr. Joshua's 'Burmese Desmidieæ', 1885, also collected within a very small space, appear 186 species and varieties of Desmidieæ; Lagerheim in his 'Desmidiaceen aus Bengalen' 1887, gives 52 species and vars. of the same order. Both these gentlemen give forms not seen by Wallich or myself; those of Mr. Joshua being (*Sphær. pulchrum*, Bail.. *β trilobum*, n. v.; *Desm. quadrangulatum*, Ralfs; *D. quadratum*, Nordst.; *Micras. crenata*, Breb.; *M. apiculata*, Ehr. f., *M. ceratophora*, ejus; *M. euastroides*, n. sp.; *Euastrum ansatum v. ampliatum; E. binale*, n, f. *crassum; E. gemmatum* Breb. *v. mononcylum* Nord.; *E. decedens*, Reinsch; *E. oblongum*, Grev. *f. scrobiculatum*, Nordst.; *E. sublobatum*, Breb.; *E. hypochondrum*, Nordst.; *E. attenuatum*, Wolle; *E. retrorsum; E. flammeum; E. coralloides; E. truncatum; E. serratum;* and *E. divergens*, spec. nov.; *Staurastrum proboscideum*, Breb. *v. Javanicum*, Nordst.; *S. margaritaceum*, Ehrb. *v. hirtum*, Nordst.; *S. gracile, formæ*; *S. vestitum*, Rfs.; *S. avicula*, Breb.. *S. Brasiliense*, Nordst.; *S. horrescens*, n. sp.; *S. leptodermum*, Ld.; *S. granulatum*, Reinsch; *S. minusculum; S. bifurcum*, ejus ex. p.; *S. cyathodes*, n. sp.; *S. platycerum*, n. sp.; *Xanthidium acanthophorum*, Nordst.; *X. antilopæum*, 2 forms; *Arthrodesmus octocornis*, Ehrb.; *A. arcuatus*, and *A. apiculatus*, sp. nov.; *Cosmarium turgidum*, Breb.; *C. De Baryi*, Arch.; *C. pulcherrimum*, Nordst. var.; *C. cucurbita*, Breb.; *C. amœnum*, Breb.; *C. pyramidatum*, Breb. var.; *C. latum*, Breb.; *C. rectangulare*, Grun.; *C. Norimbergense*, Reinsch; *C. globosum*, Bulnh.; *C. sub-tumidum*, Nord. *v. β platydesmium*, Nord.; *C. annulatum*, Nag.; *C. pachydermum*, Lund. *β minus*, Nordst.; *C. geminatum*, Lund.; *C. sub-rotundum*, Delp.; *C. bicardia*, Rsch.; *C. undulatum*, v. Schm.; *C. quadratum*, Ralfs; *C. pardalis*, Cohn. *f. minor.; C. botrytis, v. Indicum*, n. v.; and 9 n. sp. *C. euastron, C. capax, C. diadema, C. armatum, C. cuneatum, C. spinosum, C. incisum, C. inornatum*, and *C. exasperatum; Doc. minutum!* Naeg!; *Docid. baculum*, Breb.; and 3 new sp., *D. granuliferum, D. annulatum*, and *D. Burmense; D. verrucosum*, Bail. (as *D. tesselatum*, Josh.); *Closterium Lagoense*, Nord.; *C. striolatum*, Ehr.; *C. costatum*, Cda; *C. ensis*, Delp.!; *C. lineatum*, Ehr. *f. Sandvicensis*, Nord.; *C. Ralfsii*, Breb.; *C. setaceum*, Ehr.; *C. Venus*, Ktz.; *C. intermedium*, Ralfs; *C. incurvum*, Breb.; *C. porrectum*, Nordst., *C. subtile*, Breb. cum zyg. (? Cfr seq. sub *Rhaphidium*); and 2 new species, *C. bacillum* and *C. nematodes; Penium margaritaceum*, Ehr.; *P. spirostriolatum*, Barker; *P. minutissimum*, Nordst.; and

P. delicatulum, n. sp.; a total of 93. In the excellent little memoir of LAGERHEIM, l. c. in Kongl. Svenska Vet.-Akad. Handl. Bd. XIII, No. 9, 1885, there are also many Desmidieæ not seen by Dr. WALLICH, Mr. JOSHUA, or myself, they are: ***Micrasterias Mahabuleshwarensis* β *surculifera***, n. v.; ***M. ampullacea***, MASK. *β Bengalica*, n. v.; ***Euastrum quadratum***, NORDST., *E. didelta β Bengalicum*, n. v.; *E. coralloides*, JOSH. *β **trigibberum***, n. v.; *Cosmarium pulcherrimum*, NORDST. *f. Senegalensis*, NORDST.; *C. **Willei***, LAG.; *C. **Portianum***, ARCH. *β **Brasiliense***, WILLE; *C. quinarium*, LUND. *β circulare*, NORDST.; *C. **coliferum***, n. sp.; *C. biauritum*, NORDST.; *C. **retusum β læve***, ROY et BISSET; *C. **mammilliferum***, NORDST.; *C. **Meneghinii***, BREB. *β **simplicissimum***, WILLE, and *γ Wollei*, LAG.; *C. **biremum***, NORDST.; *Pleurotænopsis* (Cosmarium) *magnificus*, NORDST.; *Xanthidium acanthophorum*, NORDST. *β Bengalicum*, n. v.; *X. **Indicum***, n. sp.; *Arthrodesmus triangularis*, LAGERH.; ***Pleurotænium*** (Doc.) ***Kayei***, ARCHER; *P.* (Doc.) *ovatum*, NORD.; *P.* (D.) *Indicum*, GRUN. *β Caracasanum*, NORDST.; *P.* (D.) ***constrictum***, BAIL., * *coroniferum*, n. s-sp.; or 24 species and varieties. The short historical resumé given by LAGERHEIM is very interesting.

In a paper upon the Indian Algæ, by Drs. ZELLER and RABENHORST, in the Journal of the Asiatic Society of Bengal, vol. 42, pp. 175—193, 1873, a few stray Desmids (collected by Mr. S. KURZ in Arracan and British Burmah) only are mentioned, viz. *Clos. striolatum*, EHR.; *Pleurot. baculum*, (BREB.) DBY.; *Pl. trabecula* (= *Doc. Ehrenbergii* RLFS. non *D. **trabecula***, EHR.); ***Euastrum** ansatum*, and *E. ampullaceum*, RALFS. The main portion of Mr. KURZ' Desmid-gatherings was sent to Mr. W. ARCHER, of Dublin, and is yet unpublished.

A brief memoir by Dr. G. DICKIE of Aberdeen, 'Notes on Algæ from the Himalayas', appeared in the Linnean Soc. Journ. Bot. Vol. XIX, pp. 230—232, in 1882. In this the Desmidieæ are determined by Mr. J. ROY, viz. *Hyal. dissiliens v. tridentula*, NORDST.; *Cos. **Brebissonii***, MENGH.; *Cos. pachydermum*, LUND.; *Tet. granulatus*, BREB.; *Cyl. **Brebissonii***, MENGH.; and ***Penium** digitus* EHRB.; together with 7 new species, which as yet are not described. Most of these Algæ were from great altitudes, 15,000 to 18,000 feet!

The Algæ of my own list comprise:

	Genera	Species
Chroococcaceæ	4	6
Chamæsiphonaceæ	1	1
Oscillarieæ	3	5
Nostoceæ	2	2
Scytonemaceæ	2	3
Stigonemaceæ	2	3
Rivulariaceæ	1	2
Phycochromophyceæ	15	22
Desmidieæ	24	536
Zygnemeæ	3	?
Mesocarpeæ	1	1
Characieæ	3	5

	Genera	Species
Vaucherieæ	1	1
Volvoceæ	3	3
Palmellaceæ	8	11
Protococcaceæ	2	7
» ?	1	1
Pediastreæ	6	22
Ulothricheæ	1	2
Confervaceæ	3	4
Chætophoreæ	1	1
Oedogonieæ	1	3
Coleochæteæ	1	3
	59	600
To the Desmidieæ add the species (not included) of ROY, JOSHUA and LAGERHEIM ut ante	—	120
Chlorophyllophyceæ	59	720
Algæ	74	742

The Desmidieæ of India (including British Burmah) now amount to the large number of 656 species.

In this list the total is much reduced by the coarser Algæ having been partly discarded in collecting, and partly afterwards separated, many forms having thus disappeared; in the above summary forms and varieties are not included in the enumeration.

With respect to the classification I have adopted in the Desmidieæ, I have endeavoured to make the sequence of the genera, as to 'form', as natural as possible; but whatever is done in this direction can only be artificial, as Nature recognizes neither 'genera' nor 'species'. Various schemes have been propounded some of which absolutely darken and obscure the very subject upon which they are intended to throw light. While pursuing this subject I have written out, for comparison's sake, 22 schemes of classification, from those of MENEGHINI (1840) and KUTZING (1845), up to COOKE (1887); the only one which I can admire is that long ago proposed by Dr. WITTROCK (Points-förteckning öfver Skandinaviens växter. 4. Characeer, Alger och Lafvar. Upsala & Lund 1879—80), giving 21 genera, in following order: *Desmidium, Hyalotheca, Bambusina, Spondylosium, Sphærozosma, Micrasterias, Euastrum, Staurastrum, Xanthidium, Arthrodesmus, Cosmarium, Pleurotænium, Docidium, Tetmemorus, Closterium, Gonatozygon, Spirotænia, Penium, Mesotænium, Cylindrocystis* and *Ancylonema.* In this the objectionable division into 'filamentous' and 'non filamentous' forms finds no place (cfr ARCHER in Dubl. Club Proc. Q. J. M. S. p. 192, 1866); and moreover the sequence from and to the other classes and families is easy and natural, not abrupt. COOKE's division of the Desmidieæ into the sections *Leiosporæ* and *Cosmosporæ* is certainly incorrect; cfr LUNDELL Desm. Suec. pp. 2—4. As I have found that classifications in which the arrangement of chlorophyll is made a prominent feature interfere with generic distinctions in some cases, and thus raise awkward objections, such as those of ARCHER, ut supra, p. 71, I have myself been for years past inclined to classify by form alone. The advocates of chlorophyll-systematizing, if they are logical, will partly return to Ehrenberg's views, and absorb *Penium* within *Closterium;* this would not be nearly so objectionable as bringing, as they often do, most heterogeneous forms into close apposition.

To meet various objections, and to deal with plants having *lateral* chlorophyll, Lundell in 1871 proposed certain new subgenera. Under *Cosmarium* he gave n. sub-gen. *Pleurotæniopsis;* and under *Staurastrum* the n. sub-gen. *Pleurenterium;* but what heterogeny is thus created! In the first we find *C. ovale* Ralfs, *C. striolatum* (Näg.) Arch., and *C. elegantissimum* Lund.; and under the latter we have such forms as *Stau. grande* Bulnh., *S. Brasiliense* Nordst., and *S. sexcostatum* Bréb. 1) The only deduction I can make is that the suggestions of the distinguished author, although very ingenious, are quite 'unworkable'.

It is not for me to be hypercritical, and that chlorophyll arrangement (of which we know but too little,) is of high value I freely admit, but would any Algologist discard a distinctly lunate form from *Closterium* because it was found to have irregular chlorophyll-masses in place of the usual fillets? A knowledge of the cell-contents is as necessary to perfect understanding of the plant, as is a correct idea of the cell-form, but I submit (with extreme deference to many high authorities) that, in our present state of knowledge, we find it of more *specific* than *generic* value, i. e. so far we can confidently base ideas of classification upon it. I do not say that the advocates of classifying by cell-contents are wrong, I only suggest that their views are too advanced, and hence inconvenient for present practical use. Wallich, Desm. Beng. p. 185, says, »according to the varying periods of growth of the organism, the endochrome may be equably disposed in minute granules throughout the protoplasmic cell-contents, it may be aggregated into definitely or indefinitely shaped masses, or it may present itself in the form of radiating bands..... according as the granules have remained dispersed or have coalesced under the molecular law to which they are subject. In some genera the disposition of the endochrome must, no doubt, be regarded as highly characteristic, as, for instance, in *Docidium*, *Penium*. *Tetmemorus*, and *Closterium*. But even in different individuals of each of these genera, and in the same individual under different conditions, it will be found to vary greatly.» In considering these remarks it must not be forgotten that they were written 32 years ago; still that they contain much truth is undeniable. To the same point tend Archer's critical remarks on *Pleurotænium*, (1868) »He would not contend against the genus, ... but was not prepared to adopt it.»

Cæteris paribus, a classification by form is much more easily followed than a scheme of more elaborate construction; and it had been my intention, in this little dissertation, to have arranged *all* my Desmid-forms as nearly as I could in form-sequence, but, from long-continued sickness which delayed my work, I have been compelled to abandon the idea. However, I have appended to the principal genera outlines of sub-genera based solely upon external form, as I deem such the safer guide to a *practical* arrangement of these plants.

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1) Can any Desmids possess much more dissimilar forms than these?

In the other Algæ I have followed the classification adopted by NORDSTEDT in Fr. Alg. N. Z. 1888, pretty closely, but in reverse order.

Although not strictly within the scope of this paper, I take leave to mention certain Algæ, (although some are marine,) published by WITTROCK and NORDSTEDT in their erudite and valuable Algæ Exsicc., fasc. 1—20, 1877—1889, from the East of Asia. These are — from East India, *Rhizoclonium hieroglyphicum* (AG.) KTZ. *f. calida* (KTZ.) WITTR., No. 944; *Scytonema mychrous* AG., 673. From Ceylon, *Pithophora polymorpha* WITTR. 322; *Chætomorpha obscura,* KJELLM. 320; *Ch. antennina* (BORY) KTZ. 318; *Conferva utriculosa* KTZ. *β Ceylanica* WILLE, 430; *Sirogonium Ceylanicum* WITTR. 358; *Stephanocoelium verticillatum* KTZ. 347; *Bryopsis thuyoïdes* KTZ. 348; *Bry. pachynema* V. MARTENS (= *Valonia confervoides* HARV.), 349; *Caulerna clavifera* J. G. AG. 345; *Caul. plumaris* (FORSK.) AG. 344; *Chauvinia imbricata* KJELLM. 346; and *Ulva fasciata* DELIL. 432. From Burmah, *Euastrum obesum* JOSH. (q. v. ante), 813. From Java, *Nostoc commune* VAUCH. 589· From Borneo, *Oedogonium Kjellmanni* WITTR. 306; *Chlorodesmis pachypus* KJELLM. 343; *Halimeda macroloba* DECAIS. 339; and *Hal. multicaulis* LAMOUR. 341. From Japan, *Chætomorpha crassa* (AG.) KTZ. A total of 21 algæ; the above numbers referring to those in the fasciculi of W. & N.

The little fragments of Indian *Utriculariæ*, from the Stockholm Museum, kindly communicated by Prof. G. VON LAGERHEIM, have proved of much interest, as from them I extracted 74 species of micro-algæ, representing 18 genera. Many of the forms were new, besides others previously remarked by me; in addition to which they also comprised known forms not before noted from India. These, practically speaking, represent 6 habitats: East India, from *Utricularia fasciculata;* Eastern Himalayas, from *U. stellaris;* East Bengal, from *U. flexuosa;* Malabar, from *U. stellaris;* British Burmah, from *U. sp.;* and Khasia, upon the Brahmaputra River, from *U. sp.;* the *Utricularias* of the two latter habitats not being named. This contribution is included in my list, with the localities appended.

One fact, concerning the Desmidieæ of India, is noteworthy, viz. that in the great majority of the plants which occur also in colder climates the Indian specimens are less in size than their more frigid relatives, and for this difference it is difficult to assign a cause. There appears to be great difference between the 'sporangial periods' of the Desmids and other Algæ in various parts of India, as the time of the 'monsoons' varies very much, and upon this the aquatic plants are dependent

INDIAN FRESH-WATER ALGÆ.

(Where no habitat is stated, Bengal is understood as the locality).

Class. I. PHYCOCHROMOPHYCEÆ, Rabh.

Cohors 1. CYSTIPHORÆ, Rabh.

Ord. I. CHROOCOCCACEÆ, Næg.; Einz. Alg. p. 44.

Gen. 1. Chroococcus, Næg., l. c. p. 45.

1. **Ch.** (**minor?**), Næg., p. 47. t. I, A f. 4.
   Northern India.

Gen. 2. Gloeocapsa, (Kütz.) Næg.

1. **G. atrata,** Kütz. Phyc. Germ. p. 151; Næg. einz. Alg. p. 47, t. I, F f. 1.
   Northern India.

Gen. 3. Merismopoedia, Meyen, sec. Næg.

1. **M. glauca,** (Ehrb.) Næg., Einz. Alg. p. 55, t. I, D f. 1; *Gonium glaucum*, Ehrb. sec. Næg. l. c.
   Northern India.

Gen. 4. Tetrapedia, Reinsch, Alg. Frank. p. 37.

1. **T. gothica,** Reinsch, l. c., t. II, f. 1 c d.
   Northern India.

2. **T. foliacea,** n. sp. Species habitu fere ut in T. Crux-Michaeli Reinsch, l. c. p. 38, t. I, f. VI, sed lateribus convexo-foliatis; a latere visa acuto-lanceolata, medio paullo constricta, apicibus quasi mucronatis. Wallich Mscr. No. 311.
   Long. et lat. 11, crass. 3 μ.
   T. XX, f. 18×1,000, after G. C. W.
   Wallich styles the divisions »3 lobed». The specimen figured is apparently in a state of fission.

3. **T.? Wallichiana,** n. sp. Quadratica, forma fere exacte »Crux Melitensis», sed angulis rotundatis; quoque angulo mucrone acuta parva munito. Wallich Mscr. No. 324.
   Long. et lat. 10—12 μ.
   T. XX, f. 10×1,000.

Cohors 2. **HOMORGONÆ**, THURET.

Sub-coh. 1. **CYSTOGONÆ**, BORZI.

Ord. I. CHAMÆSIPHONACEÆ, BORZI.

Gen. 1. **Chamæsiphon**, BRAUN et GRÜN.

1. **Cham. sp.** ad *Ch. curvato*, NORDST., Alg. Sandv. p. 4, t. I, f. 1 accedens, sed articulis fere rectis.

Sub-coh. 2. **HETEROCYSTEÆ**, HANSG., sec. NORDST.

Ord. I. OSCILLARIEÆ, AGDH.

Gen. 1. **Spirulina**, LINK. 1834.

1. **S. oscillarioides**, TURPIN (KÜTZ. Tab. Phyc. 1, t. 37, f. 8; RABH. Alg. No. 1015; *S. gracillima*, RABH. Alg. No. 895; *Sp. major*, KÜTZ. Phyc. Gener. p. 183; sec. RABH. Fl. Eur. Alg. II, p. 91); WALLICH Mscr. sine descr. No. 335.
2. **S. turfosa**, CRAMER (in Hedwigia II, p. 61, t. XII, f. 1, 1863! RABH. Alg. No. 1443, et in WARTM. sub 136, sec. RABH. Fl. Eur. Alg. II, p. 92); WALLICH Mscr. No. 333.
   Diam. 4.7 μ; 5 coils in 13 μ. T. XXI, f. 16, after WALLICH. »Moving at the rate of 55 μ per minute, or 1 Inch (Engl.) in $7^{2}/_{8}$ hours.» G. C. W.

Gen. 2. **Lyngbya**, AGDH., 1824.

1. **L. rupestris**, AG. (*Oscillaria rupestris*, AG. Syst. p. 63; Engl. Fl., v., t. 377; *Phormidium rupestre*, KTZ. Tab. Phyc., t. 49, f. 4.)
   Northern India. Diam. 8.5 μ.

Gen. 3. **Oscillaria**, BOSC., 1800.

1. **O. nigra**, VAUCH. (Conf. 192, t. XV, f. 4; *Conferva fontinalis*, DILLW. Conf. t. 64.)
   Diam. 10—11 μ.
2. **O. limosa**, (ROTH.) AG. (*Conferva limosa*, Fl. Dan. t. 1549; AG. Syst. p. 66, 1824) *forma*.
   Diam. 5—6 μ.
   Central India.

Ord. II. NOSTOCEÆ.

Gen. 1. **Sphærozyga**, (AGDH.) RALFS, 1850.

1. **S. Nordstedtii**, n. sp. Species trichomatis clepsydriformibus medio rotundate incavatis; heterocystidis ovalibus. Cellulæ sporiferæ non observatæ.
   WALLICH Mscr. No. 336; W. B. T. No. 792.
   Trich. long. 4—4.5; lat. 3.7; Heteroc. 8×6 μ.
   T. XX. f. 29×600.

Gen. 2. **Nostoc**, VAUCH. Conf. 1803.

1. **N. sp.** From Northern India.
   Species indeterminable.

Ord. III. SCYTONEMACEÆ.

Gen. 1. **Scytonema,** AGDH. Syst. 1824.

1. **S. natans,** BRÉB. (in KÜTZ. Tab. Phyc. II, t. XXII, f. 1; RABH. Alg. No. 825; Fl. Eur. Alg. II 1, p. 253; BORN. et FLAH. Nost. III, p. 113, 1887?).
Central India.

2. **S. myochrous,** AGDH. (Syst. Alg. p. 40; *Conferva mychrous,* DILLW. Conf. t. XIX; Engl. Bot. I, t. 1555.)
Northern India.

Gen. 2. **Tolypothrix,** KÜTZ. Phyc. Gen., 1843.

1. **T. muscicola,** KUTZ. (Tab. Phyc. II, t. XXXI, f. 5; RABH. Alg. No. 297; Fl. Eur. Alg. II, p. 275.).
Northern India.

Ord. IV. STIGONEMACEÆ, (AGDH.) NOB.

Gen. 1. **Stigonema,** AG. Syst. p. 22, 1824.

1. **S. turfaceum,** (LINK.) COOKE (BR. Fr. Alg. p. 272, t. CXI, f. 2; *Dematium turfaceum,* LINK. Spec. I, 134; *Scytonema turfaceum,* Engl. Bot. II, t. 2517, f. 1; *Hassalia turfosa,* HASS. Alg. p. 232 (incl. Eng. Bot. t. 2826, f. 1?)! *Sirosiphon pulvinatus?* BREB. in KUTZ. Sp. Alg. p. 317; BORN. et FLAH. Nost. I, p. 257, 1886.)

2. **S. saxicolum,** NAG. in KTZ. Spec. Alg. p. 316, No. 8. (*Sirosiphon,* KÜTZ. l. c.; BORN. et FLAH. III, p. 72, 1887.)
Northern India.

Gen. 2. **Hapalosiphon,** NAG. in KTZ. Spec. Alg. p. 895.

1. **H. Braunii?** NAG., in KUTZ. Spec. Alg. p. 894.

Ord. V. RIVULARIACEÆ, RABH.

Gen. 1. **Calothrix,** AGDH. Syst. p. 24.

1. **C. Brebissonii** KÜTZ. Sp. Alg. No. 7, p. 312; *C. lanata* LENORM. non AGDH.; BORN. et FLAH. III, p. 89.
Northern India.

2. **C. tenuissima?** BRAUN (in RABH. Flor. Eur. Alg. II, p. 271, 1865; *Symphosiphon minor* HILSE in RABH. Alg. No. 1776; sec. RABH.).
Northern India.

If this is not the form of BRAUN and HILSE it is very near it, the diam. of the threads is 4.5—5 μ.

Class. II. CHLOROPHYLLOPHYCEÆ (RABH.) WITTR.

Cohors 1. CONJUGATÆ, DE BARY, 1858.

Ord. I. DIATOMEÆ, KUTZ. Phyc. Germ. p. 54, 1845.

The Diatomeæ have not been at all critically examined, but I have noted species of the following genera: *Diatoma*, *Navicula*, *Stauroneis*, *Pinnularia*, and *Synedra*.

Diatoms are not so plentiful in the gatherings as one might expect them to be, and I think no great results will accrue when the species are determined in the Bengal collection of WALLICH; but in the micro-slides of material sent from two of LAGERHEIM'S habitats there appear some forms unknown to me, and these I shall be glad to submit to a Diatomist.

Ord. II. DESMIDIEÆ (KÜTZ.) DE BARY.

KÜTZ. Syn. Diat. ex p. 1833; DE BARY Conj. 1858.

Gen. 1. Ancylonema, BERGGR. 1871.

No form hereto appertaining has yet been seen out of high Northern latitudes. The discovery of this species upon ice in the mountainous regions of the tropics would be of great interest.

Gen. 2. Mesotænium, NÄG.

GATT. Einz. Alg. p. 108, 1849.

1. **M. chlamydosporum?** DE BARY (Conjug. p. 74, t. VII D; *Palmogloea macrococca* KUTZ. Tab. Phyc. t. XXIV, f. 2), forma.

   Long. 36—40, lat. 14 μ.
   T. I, f. 3.

2. **M. Braunii,** DE BARY (l. c. p. 74, t. VII A; *Palmogloea macrococca,* AL. BRAUN, Verjüng. p. 349, t. I, II; non KÜTZ.).

   Long. 32, lat. 14 μ.
   » 42, » 20 »
   T. I, f. 4.

3. **M. sp.?**

   Long. 30—34, lat. 11 μ.
   T. I, f. 6.
   This form seems nearest to *M. Endlicherianum* NÄG. (Einz. Alg. p. 109, t. VI B.).

4. **M. caldariorum** (LAGERH.) HANSG. (Prod. Alg. Boehm. p. 174, 1888; *M. Endlicherianum var. caldariorum*, LAGERHEIM in Bot. Not. p. 48, 1886; WITTR. et NORDST. Alg. Exsicc. No. 850).

   Long. 31, lat. 12 μ.
   T. I, f. 23.

5. **M.? giganteum,** n. sp. M.? permagnum, regulariter cylindricum, 5—7-plo longius quam latum; rectum vel leniter curvatum; membrana achroa glabra; apicibus rotundatis. Cellulæ libere natantes.

Long. 120—150, lat. 19—20 μ.

T. I, f. 19.

Much like *M. De Greyii*, Nob., but far larger. I was at first in doubt that these might prove to be the cellules of a stage of *Zygnema*, but further inspection proved them not to be so, as no signs of *median* divisions are apparent.

Gen. 3. **Cylindrocystis**, Mengh.; De Bary.

Organogr. p. 26, 1838! De By. Conj. p. 74, 1858; *Penium* Bréb. and Ralfs Ex. p.; *Palmogloea* Kutz. Ex. p.

1. **Cyl.? minutissima,** n. sp. Cyl. parvissima, circ. duplo longior quam lata, utrinque rotundata, paullo in mediam partem incurvata. Membrana glabra; apicibus rotundatis.

Long. 12—13, lat. 6.5—7 μ.

T. I, f. 24.

Nearest to *Cyl. Tatrica*, Racib., from which it differs principally in being slightly constricted, and also smaller in size. From the remnants of the endochrome I judge it to be a *Cylindrocystis*.

2. **Cyl. diplospora,** Lund. (Desm. Suec. p. 83, t. V, f. 7; *Schizospora pachyderma* Reinsch, Contrib. p. 87, t. XVII, f. 1).

Long. 64, lat. 31 μ.

T. VII, f. 8 (also Wallich Mscr. No. 93).

3. **Cyl.? depressa,** n. sp. C. mediocris, circ. duplo longior quam lata; lateribus leniter incurvatis, apicibus depresso-rotundatis. A vertice visa perfecte circularis. Membrana glabra.

Long. 42—50, lat. 23—25 μ.

T. VII, f. 11, (also Wallich Mscr. No. 94).

Near to the preceding species, but smaller and slightly different in shape, and without the apical incrassation of the membrane found in *Cyl. diplospora*.

4. **Cyl. ovalis,** n. sp. C. mediocris, $2—2^1/_2$-plo longior quam lata; cellulis ovalibus, lateribus ventricosis, apicibus rotundatis. Membrana crassa, glabra.

Long. 40—42, lat. 17—20 μ.

T. I, f. 5.

This is nearest in size to *Cyl. crassa* De By., but differs from it in its regularly oval shape.

5. **Cyl. Brebissonii,** Mengh. (Organogr. pp. 5, 26, 1838; *Penium Brebissonii* Ralfs Br. Desm. p. 153, t. XXV, f. 6 b—i, non a, 1848).

Long. 40—50, lat. 20—34 μ.

Central India, J. S.; (Himalayas, Roy).

The genus Cylindrocystis, like Penium, makes two sub-genera, dependent upon the sides being plain or contracted; the sides in many forms being incurved although not »constricted».

A. **Cyclocystis** (*κυκλος*, orbis; *κυστις*, cellula). Sides not concave.

Typ. sp. Cyl. crassa, ovalis.

B. **Clitocystis** (*κλῖτος*, devexitas; etc.). Sides concave.

Typ. sp. Cyl. diplospora, depressa.

Gen. 4. Penium, Bréb.

(De Brébisson, in litt. 1846; in Ralfs' Br. Desm. 1848).

1. **P. sublamellosum,** n. sp. P. mediocre, circ. 3-plo longius quam latum, cylindricum, attenuatum; medio leviter constrictum; apicibus rotundatis, membrana lævi, vel subtiliter punctata; laminis chlorophyllaceis 9—10; locello apicali magno, corpusculos multos includentibus. Long. 85, lat. 27 μ.

T. I, f. 8, (after Wallich, Mscr. and fig. No. 99).

»Raneegunge, in July» (G. C. W.). Very similar to *P. lamellosum* Bréb., but much smaller.

2. **P. navigium,** n. sp. P. sub-majus, circ. $3^1/_2$-plo longius quam latum, lanceolatum vel naviculiforme, attenuatum, medio non constrictum, apicibus truncato-rotundatis; locellis apicalibus magnis; sutura indistincta; membrana hyalina, pallide roseola, glabra. Long. 182, lat. 52 μ. T. I, f. 9 (after Wallich Mscr. No. 91).

»Endochrome divided at central portion, pale green; one sinuous fillet occupying the central line, and sending small acicular processes (canaliculi) through the axis; . . . . Canaliculi 20, faint.» G. C. W., l. c. Probably nearest to *P. libellula*, (Focke) Nordst. [= *P. closterioides*, Ralfs], but much smaller, and broader in proportion to its length.

3. **P. bisporum,** n. sp. P. medium vel minus, circ. 3—$3^1/_2$-plo longius quam latum; cylindricum, leviter attenuatum, medio non constrictum; membrana hyalina, glabra, achroa. Locellis? Zygosporas geminas formans; in quaque capsula 3 (4?) formæ juveniles; zygosporis oblongo-rotundatis. Long. 49—70, lat. 14—22; zygs. long. max. 28—32 μ. T. I, f. 10 (after Wallich No. 100)×550.

4. **P. lanceolatum,** n. sp. P. mediocre, circ. 3-plo longius quam latum, elongatum, cylindricum, attenuatum; in medio modice constrictum. Apicibus late rotundatis; membrana punctata. Long. 81—98, lat. 26—36, lat. centr. semicell. 22—30 μ. T. I, f. 7 (after Wallich No. 101).

»Terminal vesicle not visible, but moving granules are seen clustered together and in motion at various parts of the frond. Endochrome pale green. Raneegunge, November.» — G. C. W., l. c. Somewhat similar to *P. lagenaroides*, Roy., but irregularly, and more closely, punctate; it is also much more slender than that form; in the puncta it differs from *P. Clevei*, Lund.

5. **P. simplex,** n. sp. P. rectum, circ. 9—10-plo longius quam latum, simpliciter cylindricum, non constrictum. Lateribus parallelis; apicibus truncato-rotundatis; nucleus centralis manifestus; corpusculi amylacei in unam seriem positi (4—6 in quaque semicellula); locello apicali nullo! Membrana achroa, lævis. Long. 170—198, lat. 18—20 μ. T. III, f. 9 (after Wallich, No. 119 l. c.).

I know no species at all like this, with its straight parallel sides and sub-truncate ends. No suture visible. The arrangement of the amylous corpuscles is more like that in the genus *Tetmemorus* than in *Penium*.

6. **P. polymorphum,** Perty (Kl. Lebensf., p. 207, t. XVI, f. 15), *forma* **obesum** n. f.

Forma paullo crassior quam forma typica, sed in cæteris consimilis. In fig. puncta non delineata! Long. 57, lat. 30 μ. T. VII, f. 7.

7. **P. rotundum,** n. sp. P. minus, circ. duplo longius quam latum, recte ovale; lateribus fere rectis; membrana hyalina, glabra; apicibus rotundatis; cellulis non constrictis. Sutura mediana. Long. 48, lat. 25 μ. T. VII, f. 12.

In shape somewhat resembling *P. spinospermum*, JOSHUA, but is more slender. Only two (infertile) specimens seen.

8. **P. digitus** (EHR.) BRÉB. (RALFS' Br. Desm. p. 150, t. XXV, f. 3; *Cl. digitus*, EHRB. Infus. p. 94, t. VI, f. III). *Forma* **rectum,** n. f.

P. formæ typicæ consimile sed lateribus rectis et apicibus magis attenuatis differt. Long. 440, lat. 80 μ. T. I, f. 27.

In the type the long. : lat. as 5 : 1 in the average of measurements; this form is narrower, or $5^1/_2$: 1.

Sonthal district, G. C. W.; near Hydrabad, J. S.

f. α typica. Himalayas, ROY in DICKIE l. c.

9. **P. navicula,** BRÉB. (Liste p. 146, t. II, f. 37, 1856; *P. Berginii*, ARCHER Dubl. Univ. Zool. Bot. Assoc. Rep. p. 256, t. XI, f. 14, 15, 1858).

Long. 45—54, lat. 12—13 μ.

10. **P. oblongum,** DE BARY (Conj. p. 73, t. VII, f. 1, 2, 1858) **forma major,** n. f.

Formæ typicæ consimile sed versus apices paullo attenuatum.

Long. 158, lat. 36 μ. T. I, f. 22.

11. **P. curtum,** BRÉB. (*Closterium curtum* BRÉB. in MENGH. Synops. p. 237 (no descript.!); *Cosmarium curtum*, in RALFS' Br. Desm. p. 109, t. XXXII, f. 2, 1848; *Penium curtum*, in KTZ. Spec. Alg. p. 167, 1849; *Calocylindrus curtus*, DE BY. Conj. p. 72, 1858; *Cos. Thwaitesii d curtum*, KLEBS. Des. Preuss. p. 27, 1879).

Long. 40, lat. 19 μ.

Northern India; Bengal.

Sub-genera. The division of the genus Penium into entire and constricted forms, proposed by GAY, Monogr. loc. Conj. 1884, is here (ad interim) accepted.

A. **Holopenium,** GAY l. c. p. 68. Fronds unconstricted.

B. **Sphinctopenium,** GAY l. c. p. 70. Forms constricted in the middle.

The division is so simple that no typical species need be cited.

[Note. In all probability the constricted forms will be, as indeed I think they should be, relegated to *Dysphinctium* — as, practically speaking, they might be = a section of *Dysphinctium*, i. e. elongate, and *with* apical vesicles. They might, therefore, come next to *Docidium*, as a section of *Cylindrosphinctium* NOB.]

Gen. 5. Closterium, NITZSCH, 1817.

Beitr. z. Infusor. pp. 60, 67, sec. Aut.

1. **C. acerosum** (SCHRANK) EHR. (*Vibrio acerosus* SCHRANK Fauna Boica, p. 47, III, 2, 1803; *Closterium acerosum* EHR. Abhl. 1831; Infus. t. VII, f. 1, 1838) **f. attenuata,** n. f. Paulo gracilior quam f. typica; membrana fusco-luteola, glabra; laminæ chlorophyllaceæ circ. 6; nuclei amylacei 7 in una serie. Forma ad *Cl. peracerosum* GAY accedens, sed fere duplo major.

Long. 300—310, lat. 19—24 μ.

T. I, f. 15×400 (after WALLICH Mscr. No. 107).

This form is apparently between the *Cl. peracerosum* GAY Monogr. p. 75, t. II, f. 18, and the typical form. The yellowish-brown membrane is notable. It may be that the *Cl. lanceolatum* of KUTZING is only a sub-species (*subtilissime striolatum*, KTZ. Spec. Alg. p. 165) of this typical form; BRÉBISSON, Liste p. 152, thinks they can scarcely be separated.

2. **C. Leibleinii,** KTZ. (Synops. Diat. p. 596, t. VII, f. 79, 1833! BRÉBISSON, Alg. Fal. p. 58, t. VIII, 1835; *Cl. lunula* LEIBL. Flor. p. 259, 1827, et secund. specim., KÜTZ.; *Cl. moniliferum A. Leibleinii* REINSCH Algfl. p. 190; KLEBS Desm. Preuss. p. 9) **var. angulatum** BALSAMO (Alghe Comm. Napoli p. 37, t. 1, f. 15—17) **f. minor.**

Minor quam var. Balsami; membrana glabra; nuclei amylacei (in quaque semicellula) 3 in una serie. Bengal.

Long. 120, lat. max. 31 μ. T. I, f. 18×400, after WALLICH.

α **typica, f. parva** (KLEBS l. c. No. 1). Fere ut in f. typica sed magis minor.

Long. 92—114, lat. 14—18 μ. T. XXIII, f. 13×500.

Himalayas, ex *Utricularia stellari*, comm. G. VON L.

3. **C. arcuatum** (Liste p. 149, t. II, f. 38, 1856; RALFS Br. Desm. p. 219, 1848; *C. Dianæ* KLEBS Desm. Pr. p. 11, non EHRB.).

Long. 220, lat. 19 μ. T. I, f. 17×400.

KLEBS is apparently in error in attributing this to *Cl. Dianæ*, as the absence of the little indentation at the apices of that species, (the 'petit museau' mentioned by BREBISSON,) is characteristic.

4. **C. lunula** (MÜLLER) MENGH. (NITZSCH, EHRENBERG, MORREN et aliorum, ex p., excl. syn. plur.; MENGH., Synops. in Linnæa, p. 231, 1841; *Vibrio lunula*, MÜLLER Naturforsch. XX, p. 142, 1784, sec. aut.).

Forma. F. paullo minor quam. f. typica, cytiodermate pallide lutea (non *b coloratum* KLEBS Desm. Preuss. p. 6, t. I, f. 1 a c d, 1879).

Long. 452, lat. 68 μ.

5. **C. tumidulum,** GAY (Monogr. Conj. p. 72, t. II, f. 13).

Long. 100, lat. 15 μ. T. I, f. 20.

This species appears to me but a variety of *C. Jenneri* RALFS, with acute apices; possibly intermediate between that species and *C. Leibleinii* KTZ.

6. **C. Ehrenbergii** MENGH. (Synops. p. 232, 1841; *Cl. lunula* EHRB. ex. p., t. V, f. XV, 2, 1838; *Cl. moniliferum c. Ehrenbergii* KLEBS. Desm. Preuss. p. 10, f. 4). **Forma,** ad formam a KLEBS l. c., f. 4 a accedens, sed paullo tenuior.

Long 276—296, lat. 50—59 μ.

T. I, f. 16×450; after WALLICH Mscr. No. 117.

Both this and the specimen mentioned by KLEBS are smaller than the typical European form.

7. **C. Archerianum** CLEVE (in LUNDELL Desm. Suec. p. 77, t. V, f. 13, 1871). Membrana pallide lutea (colore mutata?); striis 12.

Long. 227, lat. 20.5 μ.

I can hardly see the validity of KLEBS' views loc. cit. on this species; his f. 13 h (striis omissis) is correct, but his *b compressum* f. 11 a b is widely different; the inclusion of *C. Cynthia,* f. 12 a c, by Dr. KLEBS will not meet with general acceptance.

Central India, J. S.; British Burmah, from *Utricularia sp.*, G. v. L.

8. **C. ulna,** FOCKE (Phys. Stud. p. 68, t. III, f. 30, 1847; *C. directum* ARCHER Micr. Journ. p. 249, t. XII f. 23, 24, 1862; *C. intermedium* RALFS Br. Desm. p. 171, t. XXIX, f. 3. 1848; *C. subjuncidum* DE NOTRIS.*Elem. p. 63, t. VII, f. 68, 1867; *Cl. intermedium β directum* KLEBS Desm. Preuss. p. 16. t. II, f. 17, 1879). **Forma**

Long. 306—364, lat. 17—20 μ.

This form has the apices *slightly* less rounded, or more acute, than the type; striæ 16—18.

9. **Cl. lineatum,** EHR. (Berl. Abhandl. p. 238, 1833; Inf. p. 95, t. VI, f. VIII, 1838). Form rather shorter and stouter than the European one.

Long. 522, lat. 31 μ.

Near Nilghiri Hills? J. S.

10. **Cl. angustatum,** KÜTZING (Phyc. Germ. p. 132, 1845).

Long. 418, lat. 23 μ.

Costæ 4, spiral; membrane rufescent. Surely BRÉBISSON was in error when he informed RALFS (Br. Des. pp. 171—2) that *Cl. angustatum* had 10—12 costæ! KÜTZING says, Sp. Alg. p. 166, »costis evidentibus 4», which is apparently correct.

Central India, J. S.

11. **Cl. didymotocum,** CORDA (Alm. de Carlsbad, p. 209, No. 64, t. V, f. 64, 1835; non RALFS; *Cl. hirudo* DELPONTE, Des. Sub-alp., p. 205, t. XVIII, f. 6, 8, 1877).

Specimens intermediate between CORDA's and DELPONTE's measurements,

Long. 391, lat. 40.5 μ,
» 342, » 36 μ.

DELPONTE's dimensions are, long. 382—511, lat. 40—43 μ; while CORDA gives (probably incorrectly) long. 251 μ. Perhaps the suggestion of Dr. NORDSTEDT that *Cl. hirudo* might stand as »*β hirudo*» of *Cl. Baillyanum* BRÉB. would be better stated as *Cl. didymotocum* CORDA (non aliorum!) *β hirudo* DELP. I would further remark that the *Cl. didymotocum* of RALFS and subsequent authors would be well renamed as *Cl. fractum* (as it is broken up by its sutures into 3 or 4 parts), while *Cl. Baillyanum* BRÉB. (in litt. apud RALFS, 1845) was practically unpublished when FOCKE described and figured it as *Cl. ensis* (Phys. Stud. p. 68, t. III, f. 31, 1847; *Cl. antiacerosum* DE NOTARIS Elem. p. 61, t. VI, f. 63, 1867). The *Cl. ensis* DELP. p. 219, t. XVI, f. 14—17 seems to be a very large and attenuate form of *Penium libellula* (FOCKE) NORDST. (*Cl. libellula* FOCKE l. c. f. 29; *P. libellula,* NORDSTEDT Desm. Bornh. p. 184, 1888,) in which latter memoir the remarks, on p. 185, on the above species may be noted! I here take the opportunity of thanking Dr. NORDSTEDT for kindly permitting me to see his copy of CORDA's rare memoirs.

12. **Cl. macilentum,** BRÉB. (Liste, p. 153, t. II, f. 36. 1856).

(WALLICH, Mscr. No. 283, f. 7.).

13. **Cl. juncidum**, Ralfs (Br. Des. p. 172, t. XXIX, f. 6, 1648).
»Linear-lanceolate . . . very slightly tapering to the sub-acute extremities; lower edge very slightly inflated at middle. Terminal vesicles absent, but moveable granules occupying space between termination of endochrome and extremities of frond exist. Cells (vesicles) in a single row.» Wallich Mscr. No. 110. Long. 224, lat. 5.2 μ.

14. **Cl. Wittrockianum,** sp. nov. Cl. mediocre, diametro circ. 10-plo longius, vix arcuatum, utroque polo leniter attenuatum, ventre fere planum, dorso leviter curvatum; apicibus truncato-rotundatis; membrana striata (striis evidentibus 13), rufescente. Corpuscula amylacea, in quaque semicellula circ. 8, in serie unica posita. Sutura non observata, (duplex?). Long. 390, lat. 42 μ. *Cl. striolato* proximum. After Wallich Mscr. No. 108. T. I, f. 25×200.

I have to give outline only of this species, as it was omitted when first sketching the Plate. I have the pleasure of naming this plant after the eminent Swedish Algologist Prof. V. B. Wittrock.

15. **Cl. Wallichii,** sp. nov. Cl. mediocre, circ. 9-plo longius quam latum, leniter arcuatum, ventre non tumidum, utroque polo leviter attenuatum, membrana glabra, pallide rufescente; apicibus rotundatis; partibus dorsalibus apicum incurvatis. Sutura mediana, triplex, tripliciter prosiliens. Demi-frondes sæpe achroæ; post divisionem? Long. 386, lat. 42 μ. Tab. I, f. 13 a (after Wallich, Mscr. No. 331)×400.

Of f. 13 b Wallich says, »From internal portion of the apex a minute tube is seen to extend inwards; this tube is as long as broad (1.1 μ). It looks as though a portion of the cell-membrane had been thrust inwards. *No motion observable externally*, but from the inner point of the tube a stream of ciliary matter pours forwards towards the centre of frond, dividing almost immediately into two layers. This, probably, is an optical illusion, and most likely the mass forms a layer which continuously invests the whole frond internally. At the edges, however, *cilia* are seen, distinctly sweeping to and fro, with a wavy motion . . . . and carrying the granules round, backwards and forwards, along with it.» G. C. W. l. c.

[I only insert this to show that Ehrenberg's ideas of terminal openings and of *cilia* in the Closteria found support, in well-informed quarters, in 1855! W. B. T.]. Fig. 13 b. *g*, internal endochrome; *s*, irregular space, filled with colourless protoplasm, enclosing moving granules; *r*, dark brown cytioplasm, »ciliated»! *t*, terminal tubular »opening»! After G. C. W., l. c.

16. **Cl. nematodes,** Joshua (Burm. Des., Linn. Soc. Journ. p. 652, t. XXII, f. 7—9, 1886), *β* **proboscideum,** n. var. (*Cl. proboscideum* Turner in litt.). Cl. semi-lunatum, 1½-plo longius quam latum; f. typicæ consimile, sed majus; costatum non striatum. Membrana fusco-lutea; apud suturam stria unica transversalis.

Long. 230—265, lat. max. 26—32 μ. T. XXII, f. 13.

Khasia, super flumen Brahmaputra; comm. G. v. Lagerheim from *Utricularia sp.;* also ex *Utr. stellaris* from the Himalayas. Specimens from Riksmuseum, Stockholm.

The type is stated by Mr. Joshua, *loc. cit.*, to have 18—20 longitudinal *striæ;* this form has 11—14 strongly marked *costæ;* when fully known it may prove different from Mr. Joshua's species.

17. **Cl. subcrassum,** n. sp. Cl. minus, lunatum, membrana distincte costata (costæ 12—13), colore luteolo-fuscescente, latere ventrali leviter tumido; apicibus utrinque porrectis leniter dilatatis externe attenuatis; stria transversale unica mediana.

Long. circ. 170, lat. 40 μ. T. XXII, f. 15.

Khasia, ut supra (G. v. L.).

This possibly may only be a stout form of *Cl. Lagoense* NORDST. (Des. Bras. p. 203, t. II, f. 2, 1869). It differs in breadth, in the suture, and in the number of costæ.

18. **Cl. truncatum,** n. sp. Cl. medioore, circ. 8—9-plo longius quam latum, latere ventrali leviter tumido; fronde leniter curvata, ad apicibus attenuata; membrana dilute-luteola, striata (striis longit. 20—23); apicibus truncatis. Frons striis transversalibus 2—3, cunctis, excentricis, instructa.

Long. 250, lat. 30 μ. T. XXII, f. 14.

East India and Khasia, ut supra (G. VON L.).

This form may possibly be a short and truncate form of *Cl. Ralfsii* BRÉB. which is much larger, and not so thick at the apices. As broad as *Cl. hybridum* RABH. (Kr. Flor. Sachs., p. 174), but only half so long.

9. **Cl. acutum,** BRÉB. (in RALFS' Br. Des. p. 177, t. XXX, f. 5, 1848). f. **tenuior** NORDST. (Fr. Alg. N. Z. p. 70, t. 3, f. 27, 1888). Fere ut in descr. et in fig. a Cl. NORDSTEDT l. c. data, sed in icone Wallichiana zygospora compressa et tenuis est.

Long. cell. 60—75, lat. 5.5; long. zyg. 40, lat. 21, cr. 4.5 μ. Tab. I, f. 14 × 600 (after WALLICH, Mscr., No. 95).

WALLICH says of the side view of the spore, »elliptical-linear, much compressed».

0. **Cl. Kuetzingii** BRÉB. (Liste, p. 156, t. II, f. 40, 1856), *forma? Cl. Kuetzingio* BRÉB. in lineamentis et in striis consimile, sed fortasse in zygospora differt. Zyg. a latere late ovale, crassa. Membrana frondis pallide rufescente; striis circ. 12—15 evidentibus.

Long. 350, lat. 13; zyg. long. 36, lat.? , crass. 21 μ.

T. I, f. 12 (after WALLICH, Mscr. No. 109).

This Zygospore seems depressed, like that of *Cl. oncosporum* NORDST. (Nonn. Alg. Bras. p. 16, f. II, f. 1, 1877); it may be simply that of *Cl. Kuetzingii*, but the lateral view has not been figured in that species.

1. **Cl. regulare,** BRÉB. (Liste p. 148, t. II, f. 35, 1856; *Cl. Dianæ* FOCKE p. 68 ex. p., t. III, f. 16, 1847; *Cl. striolatum b costatum* KLEBS Des. Ostpr. ex. p. p. 14, t. II, f. 2 non f. 11, 1879).

Long. 340, lat. max. 39 μ.

Near Nilghiri Hills? one specimen only.

2. **C. striolatum,** EHRB. (Abhl. p. 68, 1833; Infus. p. 95, t. VI, f. 12, 1838; *C. striolatum a typicum* KLEBS Desm. Preuss. p. 14, t. II, f. 4 a, 1879) long. 310—346, lat. 38—44 μ.

Himalayas from *Utricularia stellaris*, comm. G. VON L.; Burmah, S. KURZ legit, Z. and R.

3. **Cl. Cynthia,** D. NOT. (Desm. It. I p. 65, t. VII, f. 71, 1867; *Cl. Archerianum var. c. Cynthia*, KLEBS Desm. Preus. p. 13, t. I, f. 12 a, c., 1879).

Long. 91—106; lat. 11—13 μ. Cfr remarks sub No. 7 supra.

Himalayas et Malabar, ex *Utricularia stellari*, comm. G. v. L. The apices are a little more acute than in the figures of De Notaris.

24. **Cl. Khasianum,** n. sp. C. medio recte, æqualiter tumidum, apicibus elongatis, spiniformibus, curvatis, incurvatis, hyalinis, finibus non dilatatis; membrana glabra. Long. = circ. $11^1/_2$ lat. max. *Cl. Kutzingio* propius, sed brevius, crassius et læve. Long. 265—292; lat. central. 23—26 μ.

Khasia, ex. *Utricularia sp.*, comm. G. v. L.

The genus Closterium forms 4 natural sub-genera:

A. **Selenoceras** (Σελήνη, luna; κερας, cornu).

Strongly incurved, lunate.

Typ. sp. C. Dianæ, moniliferum, Lagoense, Leibleinii.

B. **Campyloceras** (καμπυλος, curvatus; etc.).

Slightly curved, lower margin nearly straight.

Typ. sp. C. acerosum, lunula, striolatum.

C. **Orthoceras** (ὀρθος, rectus; etc.).

Frond narrow, more or less bacilliform.

Typ. sp. C. biclavatum, bacillum.

D. **Stauroceras** (σταυρος, crux; etc.). Kütz. Phyc. Germ. p. 133, 1845.

Frond lanceolate, slightly curved, acute. Zygospore cell normally stauriform.

Typ. sp. C. acutum, Ralfsii, rostratum, Kutzingii.

Gen. 6. Spirotænia, Bréb.

Brébisson, in litt. 1846; in Ralfs' Br. Desm. p. 178, 1848).

1. **Sp. truncata,** Archer (Proc. Nat. Hist. Soc. Dubl., t. II, f. 28—31) forma β **rotundata.** Formæ typicæ consimilis, sed paullo minor et apicibus fere rotundatis. Spira? (cytioplasma fere totum evanuit).

Long. 40—48, lat. 7—8 μ. Tab. I, f. 11.

Near Nilghiri Hills?

Two specimens only seen.

As the *external form* in this genus is almost nearly the same, with the exception, of course, of minor details, (slight curvature; ends rounded, or more or less acute, etc.,) the division by Archer in Prit. Inf. pp. 751—2, 1861, must still be accepted. The subgenera are therefore:

A. **Monotænia** (μονός, simplex; ταινία, fascia).

»Endochrome a single spiral band», Archer l. c

Typ. sp. S. condensata, S. tenerrima.

B. **Polytænia** (πολύς, multus; etc.).

»Endochrome in several spiral bands», Arch. l. c.

Typ. sp. S. obscura, rectispira, grandis?

[Is not *S. grandis*, Delp., t. XX, f. 23 in Desm. Sub-alp., a large specimen of *S. obscura* Ralfs just about to divide?].

Gen. 7. **Genicularia,** De By.

(De Bary, Conjug. p. 77, t. IV, 1858).

No specimen of this Genus has been observed in India.

Gen. 8. **Gonatozygon,** De By. (De By. emend.).

(De Bary in 'Hedwigia' I, 1856, No. 16, ex. p.; Conjug. p. 76, 1858; *Leptocystinema*, Archer, Dubl. Univ. Z. Bot. Assoc. 1858).

1. **G. Ralfsii,** De By. (Conj. p. 76, t. IV, f. 23—25, 1858; *G. monotænium* DBy in 'Hedwigia', No. 16, 1856, ex. p.; *Docidium? asperum,* Ralfs' Br. Desm. p. 158, t. XXVI, f. 6 a, b (non c!); *Leptocystinema asperum,* Archer Nat. Hist. Dubl. Proc., p. 251, t. XI, f. 5, 1858).

Formæ. a. **lævis,** Nob. Superficies cellularum fere lævis. Archer, Q. M. J. S., 1867, p. 181.

b. **muricata,** Nob. Superficies cellul. muricata. Archer, l. c. p. 198, 1869.

c. **depauperata,** n. f. Cellulæ tenues, multo graciliores quam in f. typica; 13—17-plo longiores quam latæ; sæpe paullo curvatæ, dense et subtiliter granulatæ; lateribus parallelis, apicibus paullo inflatis. T. XX, f. 4. Long. 90—120, lat. centr. 7, lat. apic. 8—9 μ.

d. **crassa,** n. f. Major; crassior quam f. typica. Superficies subtiliter setosa vel spinulosa; apices leniter inflatæ. Spinulis circ. 1.3 μ long. Long. 180—210, lat. centr. 17—19.5, lat. apic. 23—24 μ. T. XX, f. 6.

F. typica and c. near Nilghiri Hills. d. Central India. Forms a. and b. not seen. None occur in Dr. Wallich's gatherings or mscr. notes.

2. **G. Brebissonii,** De Bary (l. c. p. 77, t. IV, f. 26, 27; *Doc. asperum,* Ralfs l. c. f. 6 c (fig. bad!); Bréb. Liste p. 147, t. I, f. 33, 1856; *Lep. Portii,* Archer Dubl. Proc. l. c., t. XI, f. 6; *Gon. asperum,* auct. recent.) forma **gracillima,** n. f. G. gracile, angustissimum, elongatum; cellulis rectis, fusiformibus, diametro 15—20-plo longioribus, medio parum tumidis, versus apices sensim attenuatis; apicibus dilatatis, truncatis. Speciei longissima forma.

Long. 140—180, lat. centr. circ. 9, lat. constr. 6, lat. apic. 6.5—7.5 μ. T. XX, f. 7. Central India.

The forms of this species are analysed by Raciborski (Desm. Nov. Polon. pp. 11, 12, 1885). To Mr. Raciborski's remarks I would add that his »*forma a Gallicum*» is very doubtful, being founded upon the *defective* figure (6 c) in Ralfs!

3. **G. leiodermum,** n. sp. G. angustum, sub-curtum, cylindricum, rectum vel leniter curvatum, circ. 8—9-plo longius quam latum; apicem versus vix contractum; utroque apice dilatato, truncato. Membrana achroa, lævis. Massæ chlorophyllaceæ sub-spiraliter ordinatæ. Habitu *G. Ralfsio* consimile.

Long. 108—130, lat. centr. 14—15, lat. apic. 17—18 μ. T. XX, f. 5.

Near Nilghiri Hills? J. S.; Khasia, on the river Brahmaputra; also East Bengal, from *Utricularia flexuosa*, G. v. L.

4. **G. reticulatum,** n. sp. G. mediocre, angustum, cylindricum, rectum, 7—10-plo longius quam latum; apicem versus non contractum, utroque apice dilatato, truncato; membrana æqualiter verrucis minutis acutis reticulatim positis ornata. *G. Ralfsio* proximum.

Long. 76—120, lat. centr. 11—12, lat. apic. 14 μ. T. XX, f. 3.

Hab. Ut supra. (I have also observed this species in an American gathering, kindly sent by the Rev. FR. WOLLE). My friend Dr. NORDSTEDT asks, »Are you sure it is not an *Oedogonium*, near *Oe. punctostriatum*»? I do not know the Oedogonium referred to!

5. **G. pilosum,** WOLLE. (Desm. U. S. A. p. 22, t. I, f. 2, 1884). Hujus speciei formas duas observavi:

a. forma **minor,** n. f. Long. 120—150, lat. centr. 8—9, lat. apic. 9—10, long. spin. 4—5 μ.
b. » **evoluta,** n. f. » 160—225, » » 11—12, » » 13—14, » » 6—6.5 μ.

This is but a large and highly developed form.

T. XX, a f. 1; b f. 2.

Central India.

Note. It seems a remarkable fact that HILSE (in KIRCHNER's Algen in Kr. Flor. Schles. p. 131, 1878) and WEST (Fr. Alg. West-Yorkshire, Journ. Bot. t. 291, f. 6, 1889) have given, *independently*, the same name to the same species of this genus, *G. laeve!* The counterpart of this event occurred, when BRÉBISSON and RALFS both, also independently, had styled a Cosmarium *C. quadratum!* Cfr RALFS Br. Desm. p. 93.

The synonymy of G. Ralfsii seems a little abnormal. If the laws of priority in Botanical names are *inexorable*, then this species *must* be G. monotaenium. It seems but proper that a specific name should be protected from useless or capricious alteration by others, but may not the *original author* change it?

Moreover, DE BARY's original definition of the genus was altered by him two years afterwards, and *Genicularia* excluded; this being so, it seems that the illustrious author only exercised an undoubted right in re-naming his own species, under new generic conditions.

Gen. 9. Tetmemorus, RALFS.

(RALFS, Ann. & Mag. Nat. Hist. vol. XIV, p. 256, 1844.)

1. **T. Brebissonii,** RALFS (l. c. p. 257, 1844; Br. Des. p. 145, t. XXIV, f. 1, 1848; *Closterium Brebissonii*, MENGH. Synops. p. 236, 1840), **forma** inter *β* **minorem** DE BARY (Conjug. p. 73) et *β* **attenuatum** NORDST. (Fr. Alg. N. Z. p. 66, t. III, f. 18). Long. 100, lat. 22, lat. isth. 15 μ. T. VII, f. 9.

Northern India; the only specimen I observed of this genus; Dr. WALLICH has seen others, but has not noted or figured them.

(**Tetmemorus granulatus** (BRÉB.) RALFS, is noted by ROY in DICKIE's 'Notes on Algæ from the Himalayas' (Linn. Soc. Journ. Bot. vol. XIX, p. 231, 1882), from over 15,000 feet alt.).

Gen. 10. Triploceras, BAILEY.

(BAIL. Micr. Obs. in 'Smith. Trans.' p. 37, 1850).

1. **Tr. gracile,** BAIL. (l. c. p. 38, t. I, f. 10; *Docidium verticillatum*, BAIL. in RALFS' Br. Desm. p. 219, t. XXXV, f. 9 c; *Doc. gracile*, WITTROCK Skand. Desm. p. 21, f. 10. 1869; *Doc. pristidæ*, HOBSON, Notes, p. 169, cum fig. 1863).

Forma a. **elongata,** n. f. Paullo longior quam f. typica; lobi apicales 3, bidentati, divergentes, modice producti; semicellulæ prominentiis verticillorum 14—16

(12 ad basin semicellul.) ornatæ; et etiam ad suturam maculis vel plicaturis parvis circ. 15 preditæ. Prominentiæ verticillorum complures truncatæ; apices prominentiarum dentem brevem munitæ, fere ut in *Tr. verticillato* * *superbo* (MASK.) NORDST. (NORDST. Alg. N. Z. t. VII f. 4).

Long. 570, lat. 28; lt. apic. c. acul. 36, s. acul. 30 μ. T. II, f. 1.

Central India, J. S.; East India, ex *Utricularia sp.*, G. v. L.

I only had one specimen from East India, but it had 17 verticils in each semicell.

Forma b. **gracillima,** n. f. Trip. mediocre; lobi apicales 2, profunde bifidi, lobuli singulatim aculeati, divergentes; altera latere inter loborum spina erecta unica. Semicellulæ verticillis prominentiarum 11—14 instructæ. Forma aculeorum irregularis.

Long. 440, lat. 22; lat. apic. c. acul. 36, s. acul. 27 μ. T. II, f. 2, (also, after WALLICH No. 116, f. 2 a — side view of apex).

Raneegunge, G. C. W. — Central India. WALLICH's sketch only shows 8 whorls of prominences in each semicell. This is probably the form described by HOBSON l. c. as *Doc. pristidæ.*

c. **quadrilobata,** n. f. Forma minor, in qua apices lobulis 4 (bi-aculeati) terminati sunt. Prominentiæ verticillorum 10—12, dentibus sub-erectis, acuto-conicis, ad basin circ. 10 positis.

Long. 360, lat. 21; lat. apic. c. acul. 26, s. acul. 23 μ. T. II. f. 3.

Central India. This form is possibly a connecting link between *T. gracile* and ARCHER's *Doc. Kayei* (Nat. Hist. Soc. Dubl. Proc. vol. IV, p. 35, t. II, f. 2)?

* **bilobatum,** nov. subsp. A *Tr. gracili* typico differt prominentiis verticillorum rotundatis non acutis, dentibus rotundo-conicis (in quoque verticillo 8) non aculeatis; lobis apicalibus bi- (non tri-)lobatis, cum spinis intervenientibus apicalibus duabus, ut supra in forma b. Semicellulæ (et lobi terminales) tenuiores quam in f. **typica.** Verticilli 10—13 in quaque semicellula.

Long. 380, lat. 15, lat. apic. c. acul. 24, s. acul. 21 μ. T. II, f. 4.

Central India.

In one case (fig. 3) I observed an instance of a tridentate terminal projection; this seems abnormal. Cf. NORDST. Alg. N. Z. p. 64!

** **bidentatum** NORDST. (Alg. Bras. p. 18, t. II, f. 3, 1877) **forma depauperata,** n. f. Tr. minus, 14—20-plo longius quam latius, verticillis circ. 11 in quaque semicellula; verticillis superioribus (5) simplicibus, acutis, erectis; verticillis inferioribus (6) bidentatis; apice dilatato bilobato bidentato. Semicellulæ regulariter attenuatæ.

Long. 280—390, lat. centr. semic. 18—22, lat. apic. circ. 19 μ.

WALLICH, Mscr. No. 112.

Sonthal jungle, G. C. W.

Note. *Triploceras gracile* is perhaps the most polymorphic species known! It seems a little strange that neither Dr. WALLICH nor I have met with the closely related species *Tr. verticillatum.* A young segment of *T. gracile* is represented (after

WALLICH, No. 102) in T. IV, f. 19. In this genus the suture appears to be non-prosilient.

2. **T. abbreviatum,** n. sp. Tr. minimum, circ. 6-plo longius quam latum, rectum; lateribus parallelis; membrana glabra; sutura non prosiliente, apicibus 3—4-lobulatis, quoque lobo dente minuto terminante. Incisura mediana brevis, extrorsum ampliata.

Long. 65—85, lat. 11—15, lat. apic. 13—17 μ. T. IV, f. 17 (after WALLICH Mscr. No. 105).

»Frond linear, inflated at extremities; showing a constriction at the central portion which forms a shallow angular notch on each side. Ends truncated and inflated, the inflated portion forming 3—4 *shallow* lobes, each terminated by a short tooth. A very rare species, of which I have obtained only 2 specimens.» G. C. W. l. c.

Raneegunge, Nov. 1855.

This little form seems a trifle anomalous, when compared with others of the genus, but I think the terminal lobes decide its position.

Triploceras may be sub-divided into:

A. **Myrmechidium** (*μυρμηχιας*, verrucosus; etc.)

Fronds with rugose or nodose sides; section stellate, or crenato-rotund.

Typ. sp. T. gracile, verticillatum.

B. **Bacteridium** (*βακτηριδιον*, bacillum)

Fronds with plain or smooth sides; section circular.

Typ. sp. T. abbreviatum.

Gen. 11. **Docidium**, BRÉB.

(BRÉB. in D'ORB. Dict. IX, p. 711, 1841 (*nomen*, fide DE TONI, Sylloge p. 871); in litt. 1846; in RALFS Br. Desm. p. 155, 1848; *Closterium* ex p., et *Pleurotænium* auct. nonnull.)

1. **D. mammillatum,** n. sp. D. parvum; levissime undulatum, fere rectum, regulariter attenuatum, basi inflatum; apicibus truncatis, minute crenatis. Membrana lævis; sutura non prosiliens. Sub inflatione basis 5—6 »mammulis» vel tuberculis instructum.

Long. 240—270, lat. bas. 13, lt. apic. 9.5. T. II, f. 5.

One (semicell) only seen! Apparently nearest to *D. baculum* BRÉB. *var. β hexagonum* BØRGESEN (Des. Bras. p. 933, t. 2, f. 2, 1890).

2. **D. perlæve,** n. s. D. minus, 16—18-plo longius quam latum, fere rectum, basi (semic.) inflatum, et supra basin inflatione unica. Leniter attenuatum; apicibus truncatis; prope apices corona dentium (vel crenarum) minutarum. Membrana achroa, lævis.

Long. 270—300, lat. bas. 17, lat. apic. 10 μ. T. II, f. 6. The fact of the little teeth or crenæ being *below* the apex is peculiar.

3. **D. robustum,** n. sp. D. magnum, rectum, vix attenuatum, margine leviter sinuata, basi valde inflata, membrana glabra; apicibus truncatis, tuberculis 30—34 (singulatim positis) ornatis, unumquidque supra paullulam rugositatem. Versus apices, sub corona tuberculorum, incisura parvula incurvata. Sutura prosiliens.

Long. circ. 700, lat. bas. 63, lat. apic. 50 μ. T. II, f. 8.

4. **D. elatum,** n. sp. D. magnum, rectum; semicellulæ incavatæ, maxime crassæ ad basin et apicem; inflatione basali unica; lateribus sinuatis; membrana glabra, sutura prosili-

ente?, apicibus truncatis, tuberculis 35—40, singulatim positis, ornatis. Prope *Doc. coronatum* BRÉB., sed forma et numero tuberculorum differt.

Long. 540, lat. bas. et apic. 50, lat. centr. semic. 40 μ. T. II, f. 16.

Somewhat like the preceding species, but a comparison of the apices at once shows the difference; it is also near to *Doc. alternans* NORDST. (Desm. Bras. p. 205, t. III, f. 36, 1869), possibly a var. of that species.

Bengal, G. C. W.; East India, from *Utricularia fasciculata*, comm. G. v. L.

5. **D. quantillum,** n. sp. D. minus, circ. 9-plo longius quam latum, rectum vel leniter curvatum; regulariter attenuatum, membrana lævis vel levissime punctata, sutura prosiliente, apicibus rotundato-truncatis, dentibus 6 præditis, supra tumorem basalem tumore minore instructum.

Long. 160—195. lat. bas. 16—18, lat. apic. 9—11 μ. T. II, f. 9; T. IV, f. 12.

Resembling most *Doc. Ehrenbergii*, RALFS (Br. Des. p. 157, t. XXVI, f. 4) from which it differs in the teeth, the general outline, and in being not quite half so large. The form is very common.

6. **D. æquale,** n. sp. D. parvum, circ. 12-plo longius quam latum, rectum; supra tumorem basalem tumore minore instructum, inde non attenuatum; apicibus perfecte hemisphæricis. Membrana lævis; sutura prosiliens.

Long. 192—216, lat. bas. 17—19, lat. semicell. 12—13 μ. T. III, f. 11; f. monstrosa T. II, f. 10.

This little species seems unique. In shape it is nearest to *Doc.* (*Pleur.*) *Archerii* DELP. p. 224 (*Pl. Candianum*, t. XIX, f. 12—16!) Desm. Sub-alp. 1877, but much smaller.

7. **D. cylindricum,** n. sp. D. mediocre, circ. 10-plo longius quam latum, rectum; margine leviter sinuatum; membrana glabra; apice paullulum expanso, truncato, 38—40 tuberculis parvis instructo; in diametro regulare, vix attenuatum; basi inflatum, et paullulum supra basin; sutura non? prosiliente. Long. 280—330, lat. bas. 32, lat. semic. 26, lat. apic. 28 μ. T. II, f. 11.

Frequent in Dr. WALLICH's gathering. It is somewhat like *D. cristatum*, infra No. 26, but differs in outline, in the arrangement of the tubercles, and in the basal part of the semicells.

8. **D. nodulosum,** BRÉB. (RALFS' Br. Desm. p. 155, t. XXVI, f. 1, 1848; *Closterium crenulatum?* EHRB. Verbr. p. 123, t. IV, f. 29, 1843; *Doc.* et *Pleur. crenulatum*, auct. nonnull.) f. undata, n. f. Fere ut in f. typica sed undulata (extra inflationem basalem) usque ad apices. Undulationes 7—9. Sutura valida, prosiliens.

Long. 520, lat. bas. 62, lat. apic. 44 μ.

Central India.

RABENHORST (Fl. Eur. Alg. III, p. 142) gives the name of BREBISSON as a synon. of *Pleur.* (*Clos.*) *crenulatum*, EHRB. In this he was probably misled by EHRB., who quotes (Verbr. l. c. p. 47, No. 25) BAILEY's figure in Amer. J. Sci. (p. 302, t. III, f. 32) as the same as his *Cl. crenulatum*. In this work of EHRB. the figure is very different from BAILEY's, (one segment having teeth at the apex and no basal inflation, while the other has a basal inflation and no apical teeth!). It is very evident that

Ehrenberg's description, his figure, and his notes on Bailey's work, are all very doubtful — in fact invalid! Bailey's figure gives long. circ. 555, lat. bas. 57, lt. apic. 41 μ, and seems to be a fair representation of the form of Brébisson. Of Ehrb.'s figures, the nearest to this seems to be that of *Cl. trabecula* (Infus. ex. p. t. VI, f. II, No. 3) but the icon is very poorly drawn.

9. **D. polymorphum,** n. sp. Doc. tenue, circ. 17—19-plo longius quam latum, rectum, margine fere planum, regulariter attenuatum; membrana lævi; sutura (sed etiam non) prosiliente; apicibus truncatis, paullo rotundatis, dentibus 4 munitis. Tumor basalis plus minus prominens.

Mensuræ: Long. 308, lat. bas. 16, lat. apic. 10 μ.
» 300, » » 16, » » 10 »
» 270, » » 18, » » 9.5 » T. II, f. 13, 17; IV, f. 13.

Plentiful in Dr. Wallich's collection.

10. **D. crenulatum** (Ehr.) Wolle (Desm. U. S. Amer., p. 47, t. IX, f. 1; Roy and Bisset Jap. Desm. t. 268, f. 19; *D. nodulosum* Bréb. ex. p. auct. nonnull.; *Pleur. crenulatum* Rabh. Fl. Eur. Alg. III, p. 142, 1868; *Closterium crenulatum!* Ehrb. Verbr. Amer. pp. 81, 123, t. IV, f. 29, 1843). Cfr note under synon. of No. 8.

Long. 460—510, lat. max. 46—57 μ.

Northern India.

11. **D. rhomphæum,** n. sp. D. elongatum, tenue, 30—35-plo longius quam latum, vix attenuatum, fere rectum; apicem rotundato-truncatam, dentes 4—6 preditam, habens. Membrana glabra; sutura prosiliens. Tumores duo supra partem basalem.

Long. 320—380; lat. bas. 13, lat. semic. 9, lat. apic. 8 μ. T. II, f. 18.

Fairly common in Bengal. Somewhat resembling *D. baculoides* Roy and Bisset (Jap. Desm. f. 18), but differs in the projecting suture, and the teeth at apex.

12. **D. longiusculum,** n. sp. D. elongatum, tenuissimum, 40—46-plo longius quam latum, paullulum attenuatum; frons indistincte undulata, margine regulari; apicibus rotundatis; membrana glabra; sutura non prosiliente; basi paullo inflato.

Long. 490—550, lat. bas. 14—16, lat. centr. 12, lat. apic. 8—9 μ. T. II, f. 19.

Not uncommon.

13. **D. subcoronulatum,** n. sp. D. mediocre, fila formans. Semicellulæ diametro regulari, margine paullulum undulato, basi valde inflato, sutura paullum prosiliente; apicibus truncatis adhærentibus in fila conjunctæ; apicibus gemmis vel tuberculis (una-maculatis) 20—26 ornatis. Membrana glabra, vel subtiliter punctata.

Long. 340—400, lat. bas. 28—32, lat. apic. 24—28 μ. T. III, f. 1.

The endochrome of this species is in fillets, of which 3 or 4 are visible. At the apices a marking (fissure or plication?) proceeds from the base of each tubercle.

14. **D. alternans,** Nordst. (Desm. Bras. p. 205, t. III, f. 36, 1869) f. **minor.** Ut in f. typica sed minor. D. mediocre, fila formans! circ. 9—10-plo longius quam latius; sutura prosiliente; semicellulæ in medio attenuatæ, leviter 7-undatæ, undis alternatim majoribus; apicibus truncatis coronulá tuberculorum minorum ovatorum circ. 14 (a fronte visorum); membrana punctata?

Long. 416—470, lat. max. 46, lat. min. (centr.) 39 μ. fide Wallich.

»Frond linear, sinuous . . . . Basal and terminal inflations are the largest. Suture . . . . plain and slightly protruding. Terminal edge (apex) abruptly truncate and flat, and having round its edge a coronal of minute oval-shaped glands or processes . . . . with a central speck on each as if hollow. Colourless or very pale straw colour . . . . Very rare.» G. C. W. Mscr. Nos. 113 and 121.

15. **D. Wallichianum,** n. sp. D. magnum, egregium, circ. 11-plo longius quam latum; margine levissime undulatum, fere rectum; basi valde inflatum. Membrana sub-crassa, glabra; sutura prosiliente; apicibus incavatis et inde expansis, truncatis, 36—40 rugis acutis vel dentibus (adpressis non protrusis) ornatis. Vix attenuatum.

Long. circ. 750, lat. bas. 68, lat. apic. 54 μ. T. III, f. 2.

(Name in honour of Dr. G. C. Wallich; in token of appreciation of his learning and personal worth. W. B. T.).

16. **D. eugeneum,** n. sp. D. majus, valde elongatum, 16—18-plo longius quam latum; margine leviter sinuatum; basi (et non supra) inflatum; paullulum attenuatum; rectum vel leniter curvatum; apicibus rotundato-truncatis rugis vel stigmatis pyriformibus 20—24 preditis; membrana glabra; sutura non? prosiliente.

Long. 670—720, lat. bas. 28—32, lat. apic. 54 μ. T. III, f. 3.

17. **D. Bengalense,** n. sp. D. permagnum, egregium, crassum, 9—11-plo longius quam latius; inflatio basis plus in juvenili segmine quam in maturo protrusa. Apices versus sensim sed paullum attenuatum; ventre paullo tumido; membrana verruculosa; sutura prosiliente; apicibus truncatis paullo convexis, processubus quadrangularibus 36—40 instructis. Frondes fila formantes.

Long. 600—780, lat. bas. 65—70, lat. centr. 69—76, lat. apic. 52 μ.

T. III, f. 4 a; b. young (or aborted?) segment (ad nat.); c. showing attachments when forming filaments of several fronds (after Wallich, × 250).

Dr. Wallich gives it as »smooth or very minutely granulated», he describes the terminal processes as »elliptic glands» — the latter is hardly correct! G. C. W., Mscr. 114 and 122.

Raneegunge.

18. **D. gloriosum,** n. sp. D. longissimum, notabile, circ. 20-plo longius quam latius, rectum, supra tumorem basalem tumore minore instructum; ex inflatione basi (usque ad $^3/_4$ longit. semic.) leniter attenuatum, postea ad apicem expansum. Apicibus truncatis, processubus conicis 20—22 ornatis; sutura non? prosiliente. Membrana paullulum tenuis, lævis.

Long. 1000—1080, lat. bas. 50—53, lat. min. (circ. $^3/_4$ long. semic.) circ. 35, lat. apic. 49 μ. T. III, f. 5.

19. **D. regale,** n. sp. D. magnum, egregium, 10—12-plo longius quam latius; fere rectum; marginibus leviter undulatum; basi inflatum; membrana crassa, glabra vel subtiliter punctata; sutura prosiliente; apicibus rotundato-truncatis, coronulam elatam dentium (unaquaque tuberculifera) circ. 24 ferentibus. Frondes vix attenuatæ.

Long. circ. 624, lat. bas. 64, lat. apic. 56, lat. coronulæ 48, alt. coron. 11—13 μ. T. III, f. 6.

This beautiful species seems quite unique in having coronetted apices. The fact of the tubercles being borne upon teeth (or cuneate processes) is notable.

20. **D. sceptrum,** Roy (Desm. of Mull, in Scot. Nat. p. 39, 1883; non Kütz.; *D. tridentulum,* Wolle Desm. U. S. A. p. 52, t. X, f. 10, 1884; *Hedwigia* p. 119, 1885).

F. **punctata,** n. f. Magnitudo circa dimidium f. typicæ. Membrana punctata; punctis reticulatim vel in lineas obliquas ordinatis.

Long. 130—160, lat. bas. 8—10, lat. apic. 7—8.5 μ.

T. III, f. 10.

Near Nilghiri Hills? J. S.

21. **D. orientale,** n. sp. Doc. elongatum, 16—19-plo longius quam latius, regulare, medio paullulum attenuatum, basi inflatum; marginibus lenissime sinuatis; membrana glabra vel leviter punctata; sutura prosiliente; apicibus truncatis, paullo expansis, 36—44 tuberculis ovalibus parvis instructis.

Long. 640—700, lat. bas. et apic. 39, lat. centr. 32—34 μ.

T. IV, f. 1.

The semicells are rarely straight, usually a little sigmoid in shape, or slightly curved.

22. **D. excelsum,** n. sp. D. mediocre, 20—24-plo longius quam latum, fere rectum, regulariter attenuatum; basi inflatum, supra partem basalem 3—4 tumoribus instructum; membrana glabra?, sutura prosiliente. Apices truncatæ, dentibus acutis circ. 6 preditæ.

Long. 420—480, lat. bas. 21, lat. apic. 15 μ.

T. IV, f. 2.

Species near D. Ehrenbergii, but differing in the general outline, in the attenuate semicell, and in the acute, not conical, teeth at apex — also in the projecting suture. Probably the same as *D. Ehrenbergii var. Floridense,* Wolle (Desm. U. S. A. p. 159, 1884); however that is »without an evident suture or projecting rim», Wolle l. c.

23. **D. Ehrenbergii,** Ralfs (Br. Des. p. 157, t. XXVI, f. 4, 1848; *Clos. trabecula* Ehr. Abhl. p. 68, ex. p., 1831; Infus. p. 93, t. VI, f. II, 8 (non 1, 3, 4, 5, 7!), 1838; *Pleur. trabecula* Näg. Einz. Alg. p. 104, 1849). β **tumidum,** n. var. Fere ut in f. typica; sed semicellulæ in medio tumidæ, dentibus validibus conicis 6 ad apices munitæ. Membrana dense punctata.

Long. 340—360, lat. bas. 24, lat. apic. 22, lat. centr. circ. 25 μ.

T. IV, f. 4.

F. typica; this is noted (as *Pleur. Trabecula*) by Drs. Zeller and Rabenhorst, 1873, from Arracan; it appears also from E. India, ex *Utricularia fasciculata,* comm. G. v. L.

It seems clear from the figures in Ehrenberg's 'Infusionsthierchen' that he has included several species under a common name, and, as no evidence appears to show which was the type, it seems impossible to properly place them: hence Ehrb.'s nomenclature is apparently invalid. As the apical teeth are so marked, it is improbable that the oft-cited form of Ehrb. (Meteorp. p. 12, t. I, f. 9) can be Ralfs' species, but it must be allowed that the size given by Ehr,, circ. 225 μ long., cannot represent the true *D. trabecula,* but rather the *D. clavatum* Kutz. Ehrenberg's measures however are very fallacious. Cfr No. 50* seq.

24. **D. maculatum,** n. sp. D. permagnum, crassum, 12—14-plo longius quam latius, subrectum, basi inflatum, unde paullulum attenuatum postea versus apices dilatatum; sutura

prosiliente, apicibus truncatis, contractis, serie 30—34 tuberculorum oppositorum rotundatorum ornatis. Membrana crassa, valde punctata. Distantia punctorum 2—2.3 μ.

Long. 680—730, lat. bas. 60, lat. centr. 47, lat. apic. 50; lat. min. 42 μ.

T. IV, f. 3.

25. **D. conjunctum,** n. sp. D. sub-mediocre, sæpe in fila concatenatum, 16—18-plo longius quam latius; solum basi inflatum; margines undulatæ fere parallelæ; apices truncatæ, paullo dilatatæ, cum circ. 28—32 tuberculis parvis ovalibus instructæ. Sutura prosiliens; membrana glabra. In centro semicell. sensim attenuatum.

Long. circ. 420, lat. bas. et apic. 26, lat. centr. 22 μ.

T. IV, f. 6.

26. **D. cristatum,** n. sp. D. mediocre, elongatum, 17—19-plo longius quam latius, fere rectum, margine leniter undulatum, basi et apice inflatum; membrana glabra; sutura prosiliente; apicibus truncatis, cum circ. 30 tuberculis parvis rotundatis præditis, sub tuberçulis paullulum contractis. Mensura diametri minima in centro semicellularum.

Long. 520—560, lat. bas. 35, lat. centr. 25, lat. apic. 29 μ.

T. IV, f. 7.

Cfr *D. cylindricum*, N. 7 supra.

27. **D. Indicum,** GRUNOW (in RABH.'s Beitr. II, 1865, Desm. Ins. Banka', p. 13, t. II, f. 18) f. **major.** Forma major quarta vel tertia parte quam forma Grunovii: semicellulis supra basin minus undulatis; membrana lævi, ad apices incrassata; sutura prosiliente.

Long. 880—980, lat. bas. 29—46, lat. centr. 24—35, lat. apic. 26—39 μ.

The semicells are abruptly truncate, and the apical portion is slightly dilated. The base is inflated, the edge of the semicell above this being slightly sinuous, the centre and upper margins nearly straight; semicells a little attenuated. »Terminal vesicles large, with moving granules in each. Endochrome in long fillets, with numerous large globular vesicles scattered here and there, and also a number of smaller darker-coloured granules.» G. C. W. l. c.

T. IV, f. 8 (after WALLICH, Mscr. No. 103).

GRÜNOW gives the dimensions as, long. 724, lat. bas. 33, lat. apic. 20.5 μ, and these nearly correspond with NORDSTEDT's (Nonn. Alg. Bras. p. 17); the American specimens being rather thicker.

Bengal, G. C. W.; Himalayas, ex *Utricularia stellari*, G. v. L.

28. **D. truncatulum,** n. sp. D. minus, circ. 16-plo longius quam latius, rectum, leviter attenuatum, basi inflatum et supra basin tumore minore præditum; apicibus rotundato-truncatis; membrana punctata, apice incrassata; sutura non? prosiliente.

Long. 268, lat. bas. 17, lat. apic. 10 μ.

T. IV, f. 10.

29. **D. abruptum,** n. sp. D. parvum, 14—16-plo longius quam latum, rectum, vix attenuatum; margines fere parallelæ, basi paullulum dilatata, apicibus truncatis; membrana glabra. Sutura?

Long. circ. 300, lat. bas. 20, lat. apic. 15 μ.

T. IV, f. 11.

Near to *D. baculum* BRÉB., but much larger and not proportionally so much inflated basally.

30. **D. baculiforme,** n. sp. D. tenue, elongatum, circ. 40-plo longius quam latum, rectum, inflationes mediocres 2 apud partem basalem, postea margines rectæ; apicibus rotundato-truncatis; sutura prosiliente; membrana lævi, apice incrassata.

Long. 420—510, lat. bas. 13—15, lat. apic. 10—12 μ.

T. IV, f. 15 (WALLICH Mscr. No. 106 a).

Northern India; rather common. Differs from *D. baculoides* ROY et BISSET (Jap. Desm. f. 18, 1886) in the basal inflations, the incrassate and sharply truncate apices, and the projecting suture. »Endochrome in irregular masses and fillets. Terminal vesicles at extremities. Ends truncate.» G. C. W.

31. **D. Sonthalianum,** n. sp. D. mediocre, elongatum, circ. 20-plo longius quam latum, attenuatum, undulatum (undis 10—12 preditum), setosum; apicibus sub-rotundatis; membrana sub-crassa in apicibus incrassata; sutura obscura vel prosiliente. Semicellulæ basi non valde inflatæ.

Long. 540—590, lat. bas. 30 33, lat. centr. 20, lat. apic. 14—16 μ.

T. III, f. 8 (after WALLICH. Mscr. No. 120).

»Endochrome in long bands, with large granular masses interspersed», G. C. W.

32. **D. irregulare,** n. sp. D. mediocre, circ. 17-plo longius quam latius, rectum, regulariter attenuatum, marginibus irregulariter undulatum (undis 14—16 preditum); basi valde inflatum; apicibus truncatis; sutura prosiliente. Membrana glabra, apice crassata.

Long. 500, lat. bas. 34, lat. centr. 26, lat. apic. 20 μ. T. IV, f. 9 (after WALLICH, Mscr. Nos. 104 and 123). This form is much like *D. repandum* WOLLE (Desm. U. S. A. p. 50, t. XI, f. 1), but differs in the base being much dilated, and in a prominent suture being present.

33. **D. setigerum,** n. sp. D. mediocre, circ. 12—14-plo longius quam latius; basi inflatum, supra inflationem leviter contractum, postea inflatum, et apud apices attenuatum. Forma segminis clavata. Apicibus truncatis, leniter rotundatis; sutura prosiliente vel obscura. Membrana achroa, dense setosa.

Long. 280—340, lat bas. 22, lat. semic. max. 25, lat. apic. 14, setæ long. 2—3 μ.

T. IV, f. 5 (also WALLICH, Mscr. No. 118).

WALLICH says, »One inflation, basal . . . . extremity truncate. Covered with minute setæ or hairs. Endochrome in long fillets, passing along both segments through the suture. . . . . It would appear that the projection or otherwise of the suture ought not to be looked upon as a constant character. In the numerous specimens I have examined this character has alone been inconstant, and it is certainly insufficient of itself to constitute by its presence a distinct species». In these remarks all will agree, but it must, on the other hand, be admitted that in the majority of *Docidia* the form of the suture (when visible at all) is fairly constant!

There is a marked resemblance between this form and that described by Mr. WOLLE as *D. hirsutum* (Des. U. S. p. 51, t. X, f. 13), which is certainly *not* BAILEY's species, and which I take leave to name *D. Wolleanum,* after my valued correspondent Mr. FR. WOLLE. The above differs in having the ends truncate and the suture projecting; it differs from *D. spinosum* (WOLLE l. c. t. X, f. 12) in the clavate semicells.

BAILEY'S *D. hirsutum* (Micr. Obs. p. 36, t. I, f. 8, 1850) is truly, as WOLLE suspects, a *Gonatozygon*, and the dimensions give, long. 149, lat. 11.5—12 μ (specimen dividing!): BAILEY'S remark, »segments many times larger than broad», conflicts with his figure, the »segments» of which are only 6—7 times longer than the breadth! What the form is which Mr. ROY discovered on Deeside, Scotland, is not yet known, as ARCHER (Proc. Dubl. Micr. Club, Q. J. M. Sci., 1879, p. 438) did not give any details of its form; it is to be hoped that Mr. ROY will figure it in the forthcoming 'Scottish Desmidieæ'. ARCHER, l. c., stated that the plant was not *hirsute*, but bore *elongated papillæ!*

34. **D. crispulum,** n. sp. D. minus, vix attenuatum, 14—16-plo longius quam latum, rectum, sæpe paullo curvatum, margine regulariter undulatum (undis 11—13 ferens), basi paullulum inflatum; apicibus truncatis, 7—8 crenatis; membrana glabra. Sutura?

Long. 290—320, lat. 21—22, lat. apic. 17 μ.

T. IV, f. 14.

35. **D. salebrosum,** n. sp. D. medium, circ. 16-plo longius quam latius, rectum, margine irregulariter rugatum (superficies rugosa?); semicellulæ in basalem partem 3—4 inflationes ferentes; basi valde inflata; semic. vix attenuatis; apicibus rotundato-truncatis, 6—8 crenatis (a fronte visis); membrana sub-crassa, glabra.

Long. 450, lat. bas. 30, lat. centr. semic. 28, lat. apic. 23 μ.

T. II, f. 12.

36. **D. egregium,** n. sp. D. minus, egregium, peculiare, circ. 12—15-plo longius quam latum, rectum, e basi attenuatum; annulis lævibus pleno, reliqua parte frondis (circa annulos) punctata; annulis aut in lineas obliquas, aut irregulariter, aut spiraliter, positis; margine irregulari; sutura prosiliente; apicibus truncatis, dentibus 6 (4 a fronte visis) munitis; basi modice inflata.

Long. 240—310, lat. bas. 22—24, lat. centr. semic. 19, lat. apic. 15 μ.

T. II, f. 14, 15.

Nearest to *D. verrucosum*, BAILEY (Spec. Amer. Desm., Am. J. Sci., p. 127, f. 4 1846), from which it differs in the markings being annular, not rectangular, and in their disposition — those of BAILEY'S sp. being placed in rings round the cell. Near also to *Arthrorhabdium Moluccense* EHRB. (Abhl. Akad. Berol. p. 46, t. II, f. III, 13 a b, 1869; and to *Doc. tesselatum*, JOSH. (Burm. Desm. p. 651, t. 25, f. 15); both of which are apparently forms of BAILEY'S *D. verrucosum*. Cfr LAGERHEIM in Krit. Bemerk. zu Desm. p. 541, 1887. I am indebted to Dr. NORDSTEDT for copy of BAILEY'S little memoir and figures.

37. **D. œdematum,** n. sp. D. parvum, notabile, fila formans; circ. 8—10-plo longius quam latius; vix attenuatum (excepte apices); membrana læve vel subtilissime punctata, apice striata; semicellulis profunde 3—5 constrictis, versus apicem constrictis externe dilatatis; apicibus truncatis; sutura non prosiliente?

Long. 130—155, lat. semicell. 14—15, lat. apic. 13—14 μ.

T. II, f. 7.

Near Nilghiri Hills?

This peculiar little plant seems closely related to *D. nodosum* Bailey (Cfr No. 38) and to the *D. undulatum* of the same author (No. 39, q. v.), but it wants the nodes of the one, and the undulate form and basal plications (or stigmata) of the other. Three fronds, as depicted, only seen.

38. **D. nodosum** (Bail.) Ralfs. (*Closterium nodosum*, Bailey, Am. Desm. in Am. J. Sci. p. 127, f. 3, 1846; *Doc. nodosum* Ralfs, Br. Desm. p. 218, t. 35, f. 8, 1848; *Pleurotænium nodosum*, Lund. Desm. Suec. p. 90, 1871, et auct. nonnull.; *Pl.* (*Docidiopsis*) *nodosum*, Racib. Desm. Nov. p. 35, t. III, f. 22, 1889). Besides the type there appear to be two principal forms of this interesting species:

α. **typica** (Baileyana). Apices curtæ, late dilatatæ, crenatæ; in semic. verticillis 4, unoquoque specimine nodis 8 instructo. *Hab.* U. S. America.

β. **Anglicum,** n. v. Apices elongatæ, prope fines 10—12 nodos parvos (vel tuberculos cavos), et in finibus totidem nodulos minores conicos, habent. Noduli in quoque verticillo 6 vel 8.

Capel Curig, Wales, A. W. Wills — near Windermere, W. B. T.

γ. **dentatum,** Archer. Apices modice breves, dentatæ, dentibus non projicientibus. Noduli in quoque verticillo 6?

Galway, Ireland. Arch. in Dubl. Mic. Club, Q. J. M. Sci. 1872, p. 194. Cooke in Br. Des. p. 13, 1887, gives this a new name, »*var. Hibernicum*».

Docidiopsis nodosum, Racib. l. c. (*sub. Pleurotænio*) = *γ dentatum forma Polonica*, »lobo polari plus elongato, corona apicalis dentibus majoribus instructa,» (*nodulis* apicalibus conicis plus quam *dentibus?*). Forma prælonga; noduli in quoque verticillo 6.

In Polonia.

— — *f. Indica.* Apices breves, paullo dilatatæ, 6-dentatæ, »dentibus» (ut in *f. Polonica*) projicientibus. Noduli in quoque verticillo 6. Forma parva, brevis. Long. 208—240, lat. bas. 36—40, lat. apic. 20—21 *μ*.

Northern India.

T. III, f. 7 a, Indian specimen; 7 b, apex of *β Anglicum*, leg. A. W. Wills. The Indian form is smaller than those of Europe, America, or Britain; the base of some of the semicells is provided with peculiar processes, which appear to be instrumental in holding the segments together. For other forms of basal (and apical) processes or appendages cfr t. III, f. 4 c, and T. VIII, figs. 2, 3.

39. **D. undulatum,** Bailey (Micr. Obs. p. 36, t. I, f. 2, 1850) *Pleurotænium nobile* Richter (Hedwigia, No. 9, 1865, c. ic.); *Doc. dilatatum* Lund. (Des. Suec. t. V, f. 12, 1871) also Wolle (Des. U. S. A. p. 50, t. L, f. 32, 1884) non Cleve! Specimina Indica fila formant.

Long. 260—290, lat. bas. 13—15, lat. centr. semic. 16—17, lt. apic. 12 *μ*.

T. IV, f. 16.

Northern India.

In the Desm. U. S. A., p. 51, Mr. Wolle gives this with »apices rounded», and on t. XI, f. 5 is a figure, which cannot be *D. undulatum* Bail. The oriental specimens have the terminal striæ very faint, suture not projecting, plications scarcely visible; basal markings or stigmata strongly marked, and pyriform in shape. Apices always truncate.

I was formerly of opinion that *Doc. dilatatum* Cleve (Bidr. p. 494, t. IV, f. 6, 1863) was the same as this species, but, after a careful examination of specimens kindly communicated by Dr. O. Nordstedt, I am sure that, though nearly allied, they certainly differ. The remarks of Raciborski (Desm. Nov. 1889, p. 3) seem to indicate that he is of like opinion, but he does not observe that the species is really that of Bailey, as he attributes it to Richter; and Lundell, l. c. pp. 88—89, confuses the plants, as under *D. dilatatum* he figures *D. undulatum.*

40. **D. truncatum,** Bréb. (*Closterium truncatum* Bréb. in Mengh. Synops. p. 235, 1840; *Cl. trabecula,* Ehr. Infus. ex. p. (quoad fig. II, 1) 1838; *D. truncatum,* Bréb. in Ralfs' Br. Desm. p. 156, t. XXVI, f. 2, 1848; in litt. ap. Ralfs, 1846; *Pleurotænium truncatum* (sp. commixta!) Näg. Einz. Alg. p. 104, 1849; Rabh. Fl. Eur. Alg. III, p. 142, 1868).

Forma paullo tenuior quam f. typica.

Long. 370, lat. bas. 24, lt. max. 26, apic. 19 μ.

Northern India.

41. **D. parvum,** n. sp. D. minimum, forma sub-clavatum, circ. 8-plo longius quam latius; basi bis inflatum; prope apices attenuatum, ad apices leviter dilatatum; apicibus truncatis, angulis rotundatis; sutura prosiliente; membrana pallide rubido-luteola, glabra.

Long. 130, lat. bas. et centr. 16—17, lat. apic. 10 μ.

T. IV, f. 18. (Wallich, Mscr. No. 111).

»Slightly bulging at centre of segments, and then tapered towards the extremity, which is truncate. Suture distinct, projecting. With two inflations at base of segments, that next the suture being the larger. Empty frond of a pale reddish-yellow colour. Endochrome in irregular bands, with large granules interspersed,» G. C. W. — Common in Bengal. — Dr. Wallich observed the state of »swarming of the granules» in this species, a state which precedes death in many forms.

42. **D. inornatum,** n. sp. D. minutum, circ. 12—14-plo longius quam latum; rectum; apice versus attenuatum; basi maximum; sutura non prosiliente; apicibus rotundato-truncatis inflatio basalis nulla. Membrana glabra.

Long. 142—168, lat. 11—13, lat. apic. 6—8 μ.

T. IV, f. 20.

Much resembling *D. minutum* Ralfs (Br. Desm. p. 158, t. XXVI, f. 5, 1848 but more tumid, and attenuated slightly towards the apices, which are more abruptl truncate than in Ralfs' form.

43. **D. latum,** n. sp. Doc. latum, longit. mediocre; semicellulæ longe ovatæ; membran pallide fusco-luteola, crassa, valde punctata; apicibus late rotundatis, emarginatis? sutura ampla, prosiliente; divisione vel conjugatione incipiente sutura fissa. Form egregia in se insignes duorum generum conjungit, apicem emarginatum Tetmemor cum sutura valida Docidii! Sistit æque ac *Tetmemorus latus!*

Long. 258—260, lat. max. 63—90, lat isth. 36—40, lat. suturæ 44, membr crass. 2.3—3 μ.

T. VII, f. 1 (divisione incipiente?).

This extraordinary form in general outline is much like *D. ovatum* NORDST. (Des. Bras. p. 205, t. III, f. 37, 1869), from which it differs in being much smaller, not so elegant in shape, in having a distinct constricted portion next to the suture, also having an emargination and no *dental* prominences. Its most peculiar feature is the emarginate end, which renders the form anomalous. Dr. NORDSTEDT suggests that this may only be apparent (an *eidolon specus!*), and that it *may* consist of a double prominence. This is possible, but I would ask, why should not a Docidium be emarginate or fissured at the apices? I have an American specimen, (one segment being like *D. truncatum* and the other *D. nodulosum*,) which is emarginate at both apices; and in 1887 I obtained English specimens of those species, which I described (Naturalist 1887, pp. 275 and 290) as *D. nodulosum var. γ labiatum*, and *D. truncatum var. γ emarginatum;* to which I may add that at first I mistook the fissured ends for lateral prominences! I may be wrong, but the above figure was drawn as it seemed to be. If Dr. HANSGIRG (Prodr. Algfl. Böhm. p. 187) finds a *Dysphinctium* with emarginate apices, it is simply a similar case in a correlated form!

44. **D. rotundatum,** n. sp. Frons curta, lata, semicellulæ late oviformes, ad basin semicellularum maturarum (cell. copulativæ?) uncinas internas tres; frondis longit. = $2^1/_2$-plo latit. Membrana crassa, valde punctata, achroa vel pallide luteola; apicibus truncatis, angulis rotundatis; massa chlorophyllacea in fasciis irregulariter distributis, nucleos amylaceos plurimos involventibus.

Long. 200—215, lat. max. 80, lat. isth. 40, lat. apic. 25; membr. cr. 2.6 μ.

Northern India; Bengal. T. VII, f. 2 a.

As previously remarked, I cannot help but think that the uncinate sutural processes must assist in the adhesion of the semicells, but it may be that they play a higher part in securing the mutual cohesion of the opposing semicells at conjugation? These little processes seem to be *internal;* for with the double semicells approximated they are not visible.

45. **D. pyriforme,** n. sp. Frons sub-curta, lata; circ. $3^1/_2$-plo longior quam lata, semicellulæ pyriformes (unde nomen specificum); membrana sub-crassa, valde punctata, semicellulis ad basin constrictis, lateribus prolongatis (inter se?); apicibus truncatis, angulis rotundatis, dentibus amplis conicis 6 munitis. Sutura? Semicellula unica tantum visa.

Long. (semicell.) 96, lat. 54, lat. isth. et apic. 24, long. dent. 5.7 μ.

T. VII, f. 3.

Nearest *D. ovatum* NORDST. (Desm. Bras. p. 205, t. III, f. 37, 1869), from which it differs in size, in the suture?, and in the dental processes.

46. **D. inerme,** n. sp. Doc. curtum, latum, $2^1/_2$—3-plo longius quam latius, oblongum; semicellulæ longe ovatæ, basi inflatæ, versus apices paullo attenuatæ vel incavatæ, apices truncatæ. Membrana achroa, glabra, apice incrassata; sutura fusca-brunnea, non prosiliens, duplex vel fissa! A vertice visum orbiculare.

T. IV, f. 2 b (basis sola!). After WALLICH, Mscr. No. 92.

»Endochrome in irregular fillets or patches . . . . No terminal vesicle observable», G. C. W.

Long. 169, lat. max. 65, lat. isth. 38, lt. apic. 20 μ.

I have omitted to give full figure of this, as I formerly imagined it was the same as *D. rotundatum*, supra, but on more carefully considering WALLICH's figure I am convinced that they are distinct; Dr. W. expressly says »Frond smooth» — and it differs in various details from the preceding forms.

Notwithstanding Dr. WALLICH's remarks as to the absence of »locelli» at the apices of this species, it is reasonable to suppose, by analogy, that they exist. MASKELL (Desm. N. Z. p. 310) says that they exist in *D. ovatum* NORDST. (= *D. dilatatum* ejus, non CLEVE), and that is a cognate form.

47. D. denticulatum, GRÜNOW (Desm. u. Diat. Insel Banka, p. 13, t. II, f. 19).

Long. 270—310, lat. bas. 20—25, lat. apic. 17—19 μ.

East India, from *Utricularia fasciculata;* Himalayan District, ex *Utr. stellari*, comm. G. VON L.

These plants accord well with GRUNOW's descr. and fig., except that they only have 8 minute tubercles at the apices.

48. D. coronulatum, GRÜN. (l. c., p. 14, t. II, f. 20).

Long. 486—508, lat. max. 46—49 μ.

East India, ut sp. præcedente, G. v. L.

49. D. baculum, BRÉB. (*Closterium baculum*, Alg. Fal. p. 59, t. 8, 1835; *D. baculum* BRÉB. in RALFS' Br. Desm. p. 158, t. XXXIII, f. 5; *Cl. trabeculoides* CORDA Obs. t. 6, f. 44, 1840; *Pleurotænium baculum*, auct. nonnull.).

Long. 180—220 μ, lat. centr. semic. 11—13.5 μ.

This was noted from Burmah by Drs. ZELLER and RABENHORST, S. KURZ legit, 1873; it occurs now from E. Bengal, ex *Utricularia flexuosa*, comm. G. VON L.

50. D. trabecula, EHR. (*Closterium trabecula*, EHR. Abhl. Berl. Ak. 1831, p. 68 sec. LUNDELL; Infus. p. 93, t. VI, f. II, 4, 7; *Docidium trabecula* WOLLE, Desm. U. S. Amer. p. 48, t. XII, f. 1—3; *Pleurotænium trabecula* auct. nonnull.); *f. typica.*

Long. 380—460, lat. 22—31 μ.

East India, ex *Utricularia fasciculata*, G. VON L.

This is decidedly a »critical species», as until recently it has been synonymized along with RALFS' form, *D. Ehrenbergii*. Cfr No. 23. Consensus of opinion seems to have accepted a form with more or less swollen sides, and truncato-rotund not dentate nor crenate apices, as the true one. EHRENBERG's species is a 'multifarious' one; the figs. given in Infus. t. VI, f. II *apparently* resolve themselves into:

Fig. 1 = Doc. truncatum BRÉB.
» 2, 5 = D. clavatum KUTZ.?
» 3? 6 = D. nodulosum BRÉB.? (3. D. crenulatum?).
» 4, 7 = D. trabecula genuina?
» 8 = D. Ehrenbergii RALFS?

See the figures of WOLLE, l. c.; WEST, in Journ. R. Mic. Soc. t. II, f. 11, 1889; and of *β crassum* WITTR. Got. Öl. Sötv. Alg. t. IV, f. 17, 1872.

51. D. rectum, DELP. (*Pleurotænium rectum*, Desm. Subalp. p. 225, t. XX, f. 8—11, 1877; *Penium rectum*, WILLE Sydamer. Algfl. p. 22, 1883.

Long. 240—259, lat. bas. 16.5, lat. 13—15 μ.

East India, ex *Utricularia fasciculata*, G. v. L.

I think that this sp. is correctly placed by DELPONTE among the *Docidia*, it can hardly be a *Penium* as it possesses a decided basal inflation.

I have purposely retained the *Docidia* under their old generic appellation, not only as a question of priority, but I imagine that sooner or later the name *Pleurotænium* of NÄGELI will be discarded. As before stated, I deem it quite as reasonable to classify solely by form, as to make attempts at classification in which form and cell-contents both play a curiously commingled part. LUNDELL, to whom the acknowledgments of Algologists are due for so highly adding to our knowledge, divides the present genus into *Docidium* (without apical vesicles, and having axillary chlorophyll) and *Pleurotænium* emend. (with apical vesicles and laminar chlorophyll). His first example is *Doc. baculum* BRÉB., of which RALFS, Br. Desm. t. XXXIII, f. 5 a (indistinctly) and DELPONTE, Desm. subalp. t. XX, f. 15, 16 (distinctly) give figures *with* 'locelli' at the apices! As I have seen English specimens of this plant both with and without apical vesicles, I have considered them as a sign of age or state (yet unknown) of the Desmid; and, like WALLICH, I find their presence to be somewhat inconstant. In young and undeveloped specimens the absence of vesicles is not unexpected, but it is very puzzling to account for their frequent absence in fully developed fronds. Cfr ARCHER in Proc. Dubl. Micr. Club, Q. J. Mic. Sci., p. 262, 1865; and p. 121, 1866. For a form-classification of *Docidia*, I suggest the following subgenera:

A. **Orthidium** (*ὀρϑος* = rectus; *ἴδιος* = sui generis). Cellulis lævibus, punctatis vel granulatis. Typ. sp. Doc. truncatum, Ehrenbergii, sceptrum. B. **Rutidium** (*ῥυτιδιοω* = corrugo; etc.). Cellulis plus minus rugosis. Typ. sp. D. verrucosum, salebrosum.	Lateribus fere rectis, vel leniter curvatis.
C. **Hammatidium** (*ἅμμα* = nodus; etc.). Cellulis nodibus instructis; sectio stellatis. Typ. sp. Doc. nodosum. D. **Œdematidium** (*οἴδημα* = tumor; etc.). Cellulæ tumores ferentes; sectio circulares. Typ. sp. D. undulatum, Burmense.	Lateribus undulatis vel nodiferis.
E. **Oontidium** (*ωον* = ovum; etc.). Semicellulis plus minus ovatis. Typ. sp. D. ovatum, pyriforme.	Lateribus valde curvatis.

A classification of *Pleurotænium* (excl. *Docidium*) has been proposed by RACIBORSKI, Desm. Nov. p. 35, 1889, the foundation of which is the *basal aspect* of the semicell. In this he unites A, B and E, supra, under *Pleurotænium*, NÄG.; C under *Docidiopsis* ejus, while *Triploceras* BAIL. forms his third sub-genus, his definition of which is only framed to include the tumid and verticillate species, and not such a plant as *T. abbreviatum*, NOB.; *D. undulatum* BAIL. (as *D. nobile* RICHT.) he places under *Docidium*, l. c. p. 3. Hence, if Dr. RACIBORSKI intended to classify by basal aspect only, he should have included the

majority of the species of *Triploceras* (i. e. those with stellate sections) along with *D. nodosum* under *Docidiopsis!*

Gen. 12. **Dysphinctium,** Näg., ex. p.

(Einz. Alg. p. 109, 1849; *Calocylindrus* et *Dysphinctium*; excl. *Actinotænium*, ex. p., sensu Naegelio, sed formæ pro max. parte retentæ; *Pleurotænium* Nag.? ex.. p.; *Pleurotæniopsis* Lund. ex. p.).

1. **D. dubium,** n. sp.? D. parvum, duplo longius quam latum; semicellulæ sub-globosæ, apice rotundatæ, medio leniter sub-acute constrictæ; membrana lævis. Long. 26.5, lat. 13 μ.
   T. I, f. 1, 2.
2. **D. inferum,** n. sp.? D. parvum, duplo longius quam latius, sub-globosum; apice rotundatum; medio modice constrictum. Membrana lævis. A vertice visum circulare.
   Long. 20, lat. 10 μ.
   T. I, f. 21.
3. **D. exile,** n. sp. D. minutum, $1^1/_2$-plo longius quam latum; semicellulæ basi dilatatæ, supra recte attenuatæ, apice rotundatæ, medio paullo et leniter constrictæ. A vertice rotundatum. Membrana lævis.
   Long. 20, lat. 13 μ (also in Wallich Mscr. No. 98).
   T. I, f. 21*.
   Searsole, Oct. 20, 1855. Common, G. C. W.
4. **D. viride** (Corda) De Toni (Sylloge Chlor. p. 885, No. 16; *Dysph. Cordanum* (Bréb.) Hang. Prodr. p. 186; *Cosmarium colpopelta* Bréb. apud Archer in Prit. Inf. p. 734; *Cosmarium Cordanum* Bréb. in Rabh. Fl. Eur. Alg. III, p. 177; Turner, Journ. Roy. Micr. Soc. p. 934, t. XV, f. 4 (fig. vitiata, in separ. emend.!); *Colpopelta viridis,* Corda, Anim. Microsc., in Almanach de Carlsbad, p. 206, t. II, f. 28, 1835).
   Long. 39—45, lat. 25—28 μ.
   Northern India.
5. **D. subturgidum,** n. sp. D. magnum, circ. duplo longius quam latum; turgidum; ovale, membrana crassa, regulariter punctata, apicibus sub-rotundatis, medio incisura leniter incavato.
   Long. 140—150, lat. 66—74, lat. constr. 60—64 μ.
   T. VII, f. 4.
   Near to *C. turgidum* Bréb. (*Pleurot. turgidum,* DBy.; *Caloc. turgidus,* Kirchn. Alg. Schles. p. 142), but differs in both size and outline; being only $^3/_8$ so large and less tumid at the base of the semicells.
6. **D. grande,** Delp. (Desm. Sub-alp. p. 231, t. XXI, f. 9, 1877) **var. cuneatum.** n. v. D. maximum, latissimum, circ. duplo longius quam latius; semicellulis ovato-cuneiformibus, e basi attenuatis; membrana crassa, irregulariter punctata; apicibus late rotundatis; sinu leniter incurvato.
   Long. 195—220; lat. 95—100, lat. constr. 85—92 μ.
   T. VII, f. 5.
   Near Nilghiri Hills?
   This variety is distinguished from the type by its sides being attenuate towards the apices, which are truncato-rotundate, not simply rounded.

7. **D. connatum** (Bréb.) Reinsch (*Cosmarium connatum*, Bréb. in Ralfs' Br. Desm. p. 108, t. XVII, f. 10; *Dysph. connatum*, Reinsch, Algenfl. p. 178, 1867; *Dysph. Meneghinianum*, Näg. Einz. Alg. p. 112, t. VI G, f. 2. 1849; *Calocylindrus connatus*, Kirchn. Alg. Schlesiens, p. 143, 1878) f. **læve.**

Fere ut in f. typica, sed membrana non punctata.

Long. 66—70, lat. 50—54, lat. constr. 46—48 μ.

T. VII, f. 6.

This form is a little smaller, and the sinus more open, than in the type.

8. **D. monile,** n. sp. D. minus; fila formans; circ. $1^{1}/_{2}$-plo longius quam latius, subglobosum. Semicellulæ rotundatæ, medio leviter constrictæ, sinu incurvatæ; utraque semicellula nucleo amylaceo singulo instructa; massa chlorophyllacea versus polos fissa. A vertice visum circulare.

Long. 22.7—24.5, lat. 15—16, lat. constr. 9.5—11 μ (after Wallich Mscr. No. 97).

T. VII, f. 13.

»This species shows a constant inclination to assume the filamentous form.» G. C. W.

9. **D. retusum,** n. sp. D. minimum, $1^{1}/_{2}$—$1^{3}/_{4}$-plo longius quam latum, sub-globosum; semicellulæ globosæ; sinus rotundatus; membrana lævis, tenuissima; a vertice visum circulare.

Long. 14—16, lat. 9, lat. constric. 7 μ.

T. VII, f. 10.

Cos. globoso, Bulnheim (in Hedwigia, Bd. 2, p. 52, t. IX, f. 8, 1861) consimile sed multo minor.

10. **D. heterodoxum,** n. sp. D. parvum, circ. $1^{3}/_{4}$-plo longius quam latius, ovale, semicellulis sub-hemisphæricis, basi granulis (in lineam positis) instructis; sinu sub-acuto, breve. A vertice visum circulare. Membrana lævis, sub-crassa.

Long. 28—30, lat. 16, lat. constr. 12 μ. T. VII, f. 15.

Var. ornatum. Semicellulæ annulis duplicibus concentricis punctatis vel granulis ornatæ. T. VII, f. 14.

The smooth form might possibly be mistaken for *D. dubium* (T. I, f. 1, 2), but the basal puncta (granules?) separate it from that form.

11. **D. aspersum,** n. sp. D. mediocre, circ. $1^{1}/_{3}$-plo longius quam latius, medio modice constrictum; sub-globosum, semicellulis late rotundatis; sinu sub-acuto, interne rotundato; sutura lævi. Membrana crassa, granulis magnis in obliquas series ordinatis. A vertice visum rotundatum vel late ovale.

Habitu *D. connato* proximum.

Long. 66, lat. 48, lat. constr. 35 μ.

T. VII, f. 16.

12. **D. Cohnii** (Kirchn.) Nob. (*Calocylindrus Cohnii*, Kirch. Alg. Schles. p. 142, 1878) var. **regulare,** n. v. Longe ovale; a vertice late ovale, a latere paullulum compressum, apicibus paullo depressis. Membrana verrucosa, *nodulis in seriebus obliquis* instructa. Minor quam f. typica.

Long. 94—102, lat. 50—56, lat. constr. 42—44, crass. circ. 40 μ.

T. VIII, f. 39

Northern India.

Near to *Dys. striolatum* NÄG. (Einz. Alg. p. 112, t. VI G, f. 1) and *Dys. tesselatum* DELP. (Desm. Sub-Alp. p. 232, t. XXI, f. 13), but it is smaller than either, and the segments are attenuate and a little depressed or truncate-rotund at apex. HANSGIRG, Prodr. p. 246, makes this sp. a *var. Cohnii* of his *Cosmaridium striolatum*, but the arrangement of the granules seems to differ from NÄGELI's plant, in which the rows of granules are regularly horizontal; cfr NAG. t. VI G, f. 1 b.

13. **D. Willei**, n. sp. D. oblongum, mediocre, duplo longius quam latum; semicellulis ovalibus, apice rotundatis; incisura mediana sub-acuta, externe ampliata; membrana granulata, granulis in series horizontales (circ. 10) et transversas (circ. 9) ordinatis. A vertice ovale.

Long. 60, lat. 29, lat. constr. 19—20 μ.

T. VIII, f. 40.

Northern India; Bengal.

Nearest to *Cos. pseudamœnum*, WILLE (Syd-Amer. Algfl. p. 18, t. I, f. 37, 1883), from which it differs in the cells being larger and more ovate, also in the disposition? of the granules. Name in honour of Dr. N. WILLE, the eminent Norwegian Algologist.

14. **D. basidecorum**, n. sp. D. minus, fere duplo longius quam latius; semicellulæ globosæ, basi (in quaque) ordine granulorum (circ. 10 a fronte visorum) decoratæ, membrana reliqua lævi; sinu valde amplo, interne rotundato. A vertice late ovale, fere circulare. Membrana colore pallide fulva-carnosa

Long. 34, lat. 18, cr. 16, lat. constr. 11 μ.

T. VIII, f. 42.

15. **D. qualum**, n. sp. D. sub-mediocre, duplo longius quam latum, elongatum, medio paullulum constrictum; in centro læve Semicellulæ ovales, granulatæ, granulis in series 9 latitudinaliter positis, in lineas verticales etiam ordinatis. Sutura amplissima, rotundata. A latere visum anguste lanceolatum, modice constrictum.

Long. 40, lat. 20, crass. 12, lat. isth. 16 μ.

T. X, f. 9 (after WALLICH, Mscr. No. 158).

»*C. attenuatum* BRÉB.?» G. C. W. l. c. This species appears to be intermediate between *Cos. attenuatum* and *Cos. amœnum* BRÉB. (in RALFS' Br. Desm. pp. 110 and 102), but differs from both in the regularly ovate semicells, the rounded sinus, and in the regularly arranged granules.

16. **D. subconnatum**, n. sp. D. mediocre, circ. $^1/_8$ pars longior quam latum; ovale, apice late rotundatum; semicellulæ fere hemisphæricæ; membrana achroa, glabra. In medio leviter constrictum. Massa chlorophyllacea, in quaque semicellula, radiata.

Long. 55, lat. 47, lat. constr. 45 μ (after WALLICH, Mscr. No. 185).

This form being almost exactly in shape like No. 7 (supra), though hardly so rotund or so much contracted, I have not figured it. It is near to *Dys.* (*Cos.*) *pseudoconnatum* (NORDST.) (Desm. Bras. p. 214, t. III, f. 17, 1869), but differs in the smooth membrane and in the endochrome being in one mass, in each semicell, not in four.

17. **D. supraconnatum**, n. sp. D. sub-magnum, circ. $1^1/_2$-plo longius quam latum, longe ovale; semicellulæ sub-globosæ, regulariter rotundatæ; sinu brevissimo, apertissimo;

membrana punctata, punctis in lineas transversas circ. 15 positis, centrali parte frondis lævi. A vertice latissimo-ovale, fere circulare.

Long. 70, lat. 45, lat. isth. 35, crass. 40 μ. T. IX, f. 5.

Nearest to the related species, which are all closely similar in form to, yet different in detail from, *D. connatum* (BRÉB.) REINSCH.

18. **D. pseudoconnatum** (NORDST.) NOB. (*Cosmarium ps.-connatum*, NORDST. Alg. Bras. p. 214, t. III, f. 17, 1869; LUNDELL Desm. Suec. p. 45; *Calocylindrus pseudoconnatus* WOLLE Desm. U. S. A., p. 55, t. XII, f. 11, t. XLIX, f. 10, 11; *Pleurotæniopsis pseudoconnata* LAGERH. Alg. Bidr. p. 197).

Long. 41, lat. 26.5 μ.

This is near NORDSTEDT's Brazilian form, but much smaller than the Swedish plant of LUNDELL.

Himalayas, from *Utricularia stellaris;* East India, from *Utr. fasciculata*, comm. G. v. L.

19. **D. Lagerheimianum** (*Cosm. Lagerheimianum*, TURNER in litt. 1889). D. magnum, circ. $1^1/_2$-plo longius quam latius; elegantissimum; fere biglobulatum; semicellulis sub-circularibus; incisura mediana breve, ampliato, rotundato. Membrana sparse sed graviter punctata, nodulis vel dentibus conicis, paullo longis ornata — nodulis radiatim positis. A latere visum paullo compressum; a vertice late ovale.

Long. 120—130, lat. 74—82, lat. constr. 50—54, long. nodul. 4—7, crass. 66 μ. T. XXII, f. 6 a, b.

Khasia, super Brahmaputra flumen; et montibus Emodis (Himalayas); G. DE LAGERHEIM benigne comm.; ex Utriculariis Indicis. Clarissimo G. DE LAGERHEIMIO hanc speciem dedicavi.

20. **D. paxillosum,** n. sp. D. magnum, perlatum, circ. $1^1/_3$-plo longius quam latius; subglobosum; semicellulis sub-hemisphæricis; incisura mediana brevissima, aperta, rotundata. Membrana lævis non punctata, sed nodulis vel dentibus modice elongatis, conico-acutis vel conicis, »paxilliformibus», instructa — nodulis in lineas horizontaliter ordinatis. A vertice visum late ovale: a latere clepsydriforme, medio paullo constrictum.

Long. 120—130, lat. 85—95, lat. constr. 68—72, long. nodul. 3—5, crass. 68 μ. T. XXII, f. 5, a, b.

Khasia, etc., ut in sp. præcedente.

21. **D. conicum,** n. sp. D. parvum, circ. $1^3/_4$-plo longius quam latum, semicellulis subconicis, ventre inflatis, versus apices sensim attenuato-incurvatis, apicibus rotundatis; incisura mediana brevi, sub-acuta. A vertice visum perfecte circulare. Membrana glabra. Cytioplasma in quaque semicellula radians. Long. 14—18, lat. 8.5—11 μ.

T. I, f. 26, (also WALLICH Mscr. No. 96).

Raneegunge, Oct. 1855. »Very rare», G. C. W.

Note. This genus has a distinct connection with the preceding sub-genus of *Docidium*, from which and from certain species of *Penium* also (cfr LUND. Desm. Suec. p. 7), it differs only in the absence of 'apical locelli' — while from *Docidium* (E *Ouotidium*) it differs also in the absence of a marked suture, and decided constriction. There are argu-

ments for and against the removal of the *constricted Penia* into another genus, but, if removed, they would form a section of *Cylindrosphinctium*, and immediately follow *Docidium*.

Dysphinctium naturally divides into 2 sub-genera, according to the shape of the frond and semicells.

A. Form cylindrical (nearest to *Docidium*):
Cylindrosphinctium (*κύλινδρος*, cylindrus; *σφιγγω*, stringo).
Typ. sp. Dysph. cylindricum, cucurbita, attenuatum.

B. Form sub-globose (nearest to *Spondylosium* and *Cosmarium*):
Sphærosphinctium (*σφαιρα*, globus; etc.).
Typ. sp. Dysph. connatum, Cohnii, globosum (BULNH.) NOB.

Gen. 13. **Spondylosium**, BREB.

(BRÉB. in KÜTZ. Sp. Alg. p. 189, 1849; BRÉB. Liste p. 119, 1856; *Leuronema*, WALLICH Desm. Bengal, p. 193, 1860).

1. **Spond. ovale,** n. sp. S. mediocre, circ. $1^1/_3$-plo latius quam longum, nudum, cellulis singulis Cosmariiformibus; semicellulæ depresso-ellipticæ, lateribus rotundatis, isthmo nullo, sinu triangulari-acuto, externe ampliato; membrana glabra. A vertice ovale; a latere modice constrictum, sinu rotundo, semicellulis globosis. Corpuscula amylacea bini?

Long. 20, lat. 28, lat. constr. 9—14, crass. 11 *μ*. T. XVIII, f. 3. Divisio cellularum T. XVIII, f. 9 (sec. WALLICH Mscr. No. 65).

Bengal; also Khasia, ex Utricularia sp., comm. G. v. L.

2. **S. fragile,** n. sp. S. minus, paullo latius quam longum, depressum; semicellulæ depresso-dolabriformes, apice truncato-rotundatæ, angulis basalibus acutæ, sinu latiori, æquali, interne rotundato; isthmum distinctum ferens; membrana glabra. A vertice visum acuto-ovale; a latere globulatum leviter constrictum.

Long. 8, lat. 9, lat. isth. 3—3.5, crass. 5.5 *μ*. T. XVIII, f. 4.

Nearest to *Sphærozosma* (Spon!) *pygmæum* COOKE (Br. Desm. p. 5, t. II, f. 5) non RABH. (as R's sp. is *Cosmarium pygmæum* ARCHER, a totally different plant); the shape of the cell and sinus do not, however, agree with COOKE's species.

3. **S. nitens** (WALLICH) ARCHER (in Proc. Dubl. Micr. Club, 29 Apl. 1870; LUNDELL Desm. Suec. p. 93; *Leuronema nitens* WALL. Desm. Bengal. p. 193, t. VII, f. 10—14, t. VIII, f. 12, 13, 1860).

S. cellulis paullo latioribus quam longis; zygosporæ globosæ. Interdum conjugatio lateralis faciens? *α* typica, WALLICH l. c. f. 10, 11.

A. No isthmus.

1. *α* **typica f. major.** Long. 25—27, lat. 28—30, lat. constr. 9, crass. 16—17 *μ*. G. C. W. Mscr. 69.
2. — — **f. minor.** Long. 14—15, lat. 16—17, lat. constr. 7—8, crass. ? *μ*.
3. **var.** *β* **triangulare,** n. v. Triangulare, valde constrictum.

Long. 21—25, lat. 24, lat. constr. 8—10 *μ*; WALLICH l. c. p. 194 **var.** *γ*, t. VIII, f. 12, 13; Mscr. No. 62.

B. A decided isthmus.

(var. β Wallich, t. VII, f. 12—14).

4. **var. β triangulare f. producta,** n. f. Long. 25—28, lat. 24—25, lat. constr. 10, long. isth. 5—6 μ. Wallich, Mscr. No. 62, f. 3.

5. — — — **f. tensa,** n. f. Long. 26—35, lat. 25—32, lat. constr. 8—10, long. isth. 6—8 μ. Wallich, Mscr. No. 62, f. 3 a.

T. XVIII. 1, f. 7; 2, f. 6; 3, f. 17 a, c; 4, f. 17 b; 5, f. 10, 11.

Wallich, in Desm. Beng. gives dimensions:

1. Long. 16—20.5, lat. 20.5—30.5 μ.
2. » 20.5—26, » 18—30.5 μ.
3, 4. » 20.5—26, » 20.5—30.5 μ.

The spherical zygospores are of a reddish brown colour when mature, and are about 17—20 μ in diameter. In the 3-angled var. the endochrome is triradiate, each ray bifid, as in Staurastrum commonly. The discovery of the elongated forms sets at rest the question that an isthmus may normally exist within this genus; cfr De Toni (Sylloge p. 792, definitio generis) 'isthmis nullis'! Wallich's icons ex Mscr. (copied *in part* by me) appear to give a suggestion that *lateral* conjugation *may* occur, although he figures zygospores in abnormal positions. Nordstedt, in litt., asks »How can a passage or tube be formed between the apices of two old Desmid-cells?» The question is hard to answer, but, as Desmidian anomalies are of frequent occurrence, I would suggest that if lateral conjugation can and does occur in the *Zygnemaceæ* it may also take place in the filamentous *Desmidieæ*.

4. **S. incurvatum,** n. sp. Spon. egregium; circ. sexta parte latius quam longum, isthmum distinctum habens; semicellulæ ovato-incurvatæ, dorso paullo protentæ, planæ; incisura mediana profunda, æquali, interne rotundata, maxime infra, apertura paullo constricta; membrana glabra. A vertice visum compresso-ovale; a latere clepsydriforme modice constrictum. Conjugatio scaliformis vel lateralis. Zygospora globosa, lævis, membrana tenui.

a. **major.** Long. 24—26, lat. 27—30, lat. isth. 7—8, crass. 15—16 μ.
b. **minor.** » 16—19, » 24—26, » 6, » 11—13 »

T. XVIII, f. 8. Wallich, Mscr. No. 67.

This sp., like the preceding, appears able to conjugate as certain of the *Zygnemaceæ* both laterally and with opposed cells of its own or another filament. Dr. Nordstedt (in litt.) suggests that the spore-like bodies *within* the cells may be of parasitic origin; this I cannot explain; neither can I give any explanation of the globular spore-like body shewn by Wallich as being placed *between the apices* of two cells, and noted by him. In 67 c Wallich says, »here and there an *empty* joint (cellule) having a sporangium *at its central part*, in this case pale reddish-green». The only solution of this strange appearance seems to be that copulating filaments *may* dissociate after part-completion of union, and that the resulting zygospores *may* remain, here and there, attached to one filament. The Zypospore is colourless or pale red; »at *a* the sporangial cell appears to spring *from the junction between two joints*, at *b* from an isthmus between segments.» G. C. W. (Fig 7 is ad nat., the spore only copied from Dr. W.;

fig. 8 is all after WALLICH). The Zygospore has a diameter of 15—18 μ. The length of the isthmal portion of the frond is 2.5—3.8 μ.

5. **S. Mungulporeanum,** n. sp. S. minutum; fere tam longum quam latum, depresso-ovale; sinu profundo, interne æquali, parumque aperto, externe valde ampliato; semicellulæ ovatæ, lateribus acutæ, dorso depressæ; membrana glabra; isthmo curto sed distincto inter semicellulas. A vertice visum ellipticum, apice acutum; a latere clepsydriforme, modice constrictum.

Long. 8—9, lat. 9, lat. isth. 1.7—2; long. isth. 0.8—1.4; crass. 3.5 μ. T. XVIII, f. 14.

Certain correspondence I have lately had with Algologists induces me to state that I consider that when the sinus of a plant is linear the length of isthmus is practically *nil*, but when in this genus I refer to species possessing *isthmi* my remark tends to show that between the semicells there is a distinct and more or less elongated (though laterally constricted) 'neck'. — It may surely be granted that an isthmus *may* possess length as well as breadth!

6. **S. rectum,** n. sp. S. mediocre, fere tertia parte latius quam longum; quadraticum; semicellulæ depresso ellipticæ, dorso planæ, lateribus rotundatæ; membrana lævi; sinu amplo, aperto, sub-æquali, interne rotundato. S. isthmo parum longo, distincto. A vertice visum compresso-ellipticum; a latere angusto-clepsydriforme, medio modice constrictum.

Long. 14—16, lat. 22, lat. isth. 6—7, crass. 7—8 μ. T. XVIII, f. 20.

The isthmus is rather long (3.5—4 μ) for the size of the frond.

7. **S. reniforme,** n. sp. S. magnum, circ. quarta parte latius quam longum, ovale, valde constrictum; semicellulæ reniformes, dorso supplano-convexæ, basi paullo dejectæ, lateribus rotundatæ; membrana glabra; sinu angusto, extrorsum paullulum contracto. A vertice visum compresso-ovale. Habitu fere cum *Cosmario phaseolo* BRÉB. comparandum.

Long. 23—25, lat. 30—32, lat. constr. 5—7, crass. 13 μ. T, XIX, f. 6.

In this species there is an Isthmus, but it is only about 2.5 μ long.

8. **S. lamelliferum,** (CORDA) NOB. (*Sphærozosma lamelliferum* CORDA, Micr. Obs. in Alm. Carlsb. p. 206, t. IV, f. 29, 1840; ARCHER in Prit. Inf. p. 724, 1861; RALFS Br. Desm. p. 208; WILLE Norges Fersk-alg. p. 58, t. II, f. 40? 1880) var. **attenuatum,** n. v.

Semicellulæ late ellipticæ, non reniformes ut in f. typica, lateribus acuto-rotundatæ, apud marginem lateralem macula unica instructæ, dorso leniter convexæ, apice in processu brevi truncato (latit. fere duplo longit.) producta; membrana glabra; sinu profundo amplo fere æquali interne rotundato. A vertice visum compresso-ellipticum; »lamella» tenui-elliptica.

Long. 12—14, lat. 19—33, lat. constr. 5—6, crass. 7—8 μ.

T. XXI, f. 2×700, after WALLICH Mscr. No. 53.

This seems to be very near to CORDA's species, especially as WALLICH remarks of the *lamella*, »a distinct narrow band, the *half* of which is always observable on each separated joint (frond)». ARCHER, l. c. says »connecting process 'flattened', colourless» — this is exactly after CORDA, »membre de réunion feuilleté, blanc», so that the protrusion at the apices, as shewn by WALLICH, is hyaline. The only difference between this variety and the type is that the former has narrowly elliptic and not reniform semicells, this also alters the form of the sinus. WILLE, l. c. gives long. and lat. 12, crass 7 μ; his plant however has oval, not reniform, semicells, and the mode of juncture is not apparent. I consider that as the plant conjoins in filament by the apical surface, and not by 'rods' or 'cushions', it is a *Spondylosium*.

9. **S.? geminatum,** WALLICH (*Sphærozosma geminatum*, WALLICH Mscr. Nó. 68, 1855).

Semicells long. 7—20, lat. 13—18 μ.

T. XXI, f. 4, 5, after G. C. W. l. c.

This plant seems to be a very aberrant member of the genus, and WALLICH has given no description with the icons! Fig. 4×500 shews the cell-division; f. 5×1000, the two views of a filament; c semicell dividing?

Another form (apparently) of this strange plant is shewn at f. 3, taken from WALLICH's Mscr. No. 48; dimensions:

Fronds, long. 9.7—29.2, lat. 6.5—13 μ; G. C. W. No description given.

Lower Bengal.

The only distinction between the various Spondylosia appears to be the presence or or absence of an elongation or protrusion at the conjoined apices, as in *S. lamelliferum*, which in its projecting 'leaflets' is unique.

Gen. 14. Cosmocladium, BRÉB.

(Liste p. 133 1856; RABH. Fl. Eur. Alg. sub *Palmellaceæ!* p. 53, 1868).

No plant referable to this genus has been noted; cfr remark under *Dictyosphærium*.

Gen. 15. Cosmarium, (CORDA) RALFS, emend.

(CORDA, Obs. in Alm de Carlsbad, 1835, ex. p.; RALFS Br. Desm. p. 91, excl. *Dysphinctii* sp.).
»Frondes non lobatæ, nec apicaliter incisæ; sine aculeis et radiis», RALFS l. c.

1. **C. serratum,** n. sp. C. minus, reniforme, fere tam longum quam latum; semicellulæ basi inflatæ, apice rotundatæ, sinu lineari, extrorsum ampliato; membrana lævi margine excepta; margine serrata vel minute dentata (dentibus acutis circ. 20 in unam seriem semicell. ordinatis. A latere visum ovato-lanceolatum; a vertice ovale.

Long. 14, lat. 13, lat. isth. 4, crass. 6 μ.

T. VII, f. 18.

2. **C. coloratum,** n. sp. C. parvum, circ. $1^1/_2$-plo longius quam latius; truncato-ovatum; sinu profundo lineari; semicellulis truncato-pyramidalibus, angulis basalibus rotundatis, apicibus rotunde truncatis; membrana apud margines sparse granulata (granulis concentrice ordinatis), colore pallide fusco-luteola. A vertice visum ovale.

Long. 37, lat. 25, lat. isth. 9 μ. T. VIII, f. 14.

Nearest to *C. ps.-pyramidatum*, LUND. (Des. Suec. p. 41, t. II, f. 18), from which it differs in form, besides being distinctly granulate at the edges, the centre of frond and semicells being smooth, and also in colour of membrane.

3. **C. Turpinii, BRÉB. (Liste p. 127,** t. I, f. 11; LUNDELL Desm. Suec. p. 29).

Long. 68, lat. 62, lat. isth. 17 μ.

The form has one central inflation alike the normal plant of Bréb. The Swedish form described by Lundell, l. c., seems to be analogue of the variety of *Euastrum turgidum* Wallich, q. v., both of which possess 2 tumid central portions; cfr also Racib. Des. Polon. t. XI, f. 9.

4. **C. contractum,** Kirchn. (Alg. Schles. p. 147, No. 311, 1878; *Colpopelta deplanata?* Corda, Obs., p. 241, t. IV, f. 24, 1839).

Long. 35, lat. 26, lat. isth. 10 μ.
» 32, » 22, » » 9 μ.
T. VII, f. 33, 34, 19. Crass. 18 μ.

Var. **punctatum.** F. typicæ consimilis, sed multo major et membrana punctata. Long. 47—52, lat. 35—38, lat. isth. 12—14 μ. T. VII, f. 38; T. IX, f. 21.

Bengal, rather common; Northern India.

5. **C. tithophorum,** Nordst. (Alg. Nonn. Lugd.-Bat. p. 6, t. I, f. 6, 1880) forma **irregularis.** A fronte visum ut in f. typica, sed differt lateribus sinus irregularibus vel undulatis.

Long. 21, lat. 22, lat. isth. 6 μ. T. VII, f. 20.

6. **C. concinnum** (Rabh.) Reinsch. (*Euastr. concinnum*, Rabh. Alg. Europas, 1204 and 1303, fide Reinsch; *Didymidium* (*Cosm.*) *concinnum*, Reinsch, Algenfl. p. 111, t. IX, f. 3 (excl. fig. f?) 1867).

Long. 15, lat. 12, lat. isth. 3.5 μ. T. VII, f. 21.

I am strongly of opinion that this should be named, by priority, *C. angulosum*, Bréb. (Liste, p. 127, t. I, f. 17) figure ill-drawn; and, again, both have been classed under *C. Meneghinii;* however, until *all* their Zygospores are known, they had better remain separate.

7. **C. læve,** Rabh. (Rabh. Fl. Eur. Alg. III, p. 161, 1868) f. **minor.** Circ. duplo minor quam f. typica; membrana granulata?

Long. 14, lat. 12, lat. isth. 4 μ. T. VII, f. 22; VIII, f. 21.

»Distincte granulato»! Rabh. l. c. The form figured resembles that of Wolle (Des. U. S. A. p. 62, t. XV, f. 10) rather than the ones given by Nordstedt and Wille. The form on T. VIII, f. 21 is also much like Wolle's, but with *'isthmo aperto'*, long. 22, lat. 18, lat. isth. 7 μ. Since writing these Notes Dr. Nordstedt informs me that Dr. Rabenhorst (in litt.) con[illegible]d his determination of this species, which is often heavily punctate but not granulate.

8. **C. perpastum,** n. sp. C. magnum, egregium, fere duplo longius quam latius; sinu breve, lineari. Semicellulæ a fronte visæ rotundo-triangulares, basi inflatæ; membrana crassa, punctata; punctis in lineas ordinatis, ut margine 'radiata' visa est. A latere ellipticum, sine constrictione, toto ventre inflato — »peniiforme», quasi ut in specie Penii. C. habitu fere *C. binervi*, Lund. (Desm. Suec. t. III, f. 19) sed differt in medio tumido (a latere), et notis differentiis.

Long. 90—102, lat. 52, lat. isth. 32, crass. 48—52 (after Wallich, Mscr. No. 141). T. VII, f. 23.

»Endochrome frequently in long irregular bands, continuous. Side view elliptical, no constriction visible. This species seems to form the connecting link between *Cosmarium* and *Penium*. *Cos. turgidum*, Bréb., var. *β*,» G. C. W. The species certainly

does resemble BRÉB.'s plant, which is a *Dysphinctium*, but it is much less, and the suture and side view differ.

9. **C. maculatum,** n. sp. Cos. majus; late ovale, circ. duplo longius quam latius; semicellulæ angulis inferioribus rotundatis; apicibus late rotundatis; membrana tenui, dense et graviter punctata; sinu brevi, aperto, interne rotundato, extrorsum paullo ampliato. A vertice visum late ovale; a latere bi-ovale; distincte constrictum, paullo compressum.

Long. 145—160, lat. c. 75, lat. isth. 47, cr. circ. 48 μ. T. VII, f. 31.

Forma. Levissime punctata. T. VIII, f. 68.

Long. 145—155, lat. 70—80, lat. isth. 46—48 μ.

This form is near to *C. pseudo-pachydermum* NORDST. (Fr. Alg. N. Z. p. 53, t. V, f. 20) but differs in being more slender, and having rotund apices, the sinus also is open, not linear.

10. **C. tumescens,** n. sp. C. permagnum, vix duplo longius quam latius, late ovale; modice constrictum, sinu mediocre, aperto, extrorsum ampliato; semicellulæ late conicæ, angulis inferioribus subito rotundatæ, apice truncato-rotundatæ. Membrana crassa, subtiliter punctata. A vertice late ovale, a latere elliptico-orbiculare. Species inter *C. pachydermum* LUND. (Des. Suec. p. 39, t. II, f. 15) et *C. ps.-pachydermum* NORDST. (vide No. 9).

Long. 142—155, lat. 78—84, lat. isth. 52, cr. circ. 56 μ. T. VII, f. 32.

[The true *C. pachydermum* LUND. was noted by ROY, from the Himalayas, 1882.]

11. **C. panduriforme,** n. sp. C. mediocre, circ. duplo longius quam latius, ovale; medio constrictum, sinu lineari, brevi; semicellulæ pyramidales, angulis inferioribus subito rotundatæ, fere rectæ; lateribus leniter curvatæ, apicibus acuto-rotundatæ. Membrana achroa, minute punctata. A vertice latissime ovale, fere circulare; a latere ovato-lanceolatum, in medio paullo constrictum, fere ut in Diatoma *Navicula pandura* BRÉB. (Diat. Littoral Cherbg. p. 253, f. 4, 1854). Massa chlorophyllacea centralis? in tæniis irregularibus disposita.

Long. 90, lat. 43, lat isth. 28, crass. 29 μ (fide WALLICH, Mscr. No. 143).

Tab. IX, f. 3. *C. ps.-pyramidato* LUND. **stenonotum* NORDST. in NORDST. et WITTR. (Desm. et Œdog. p. 32, t. XII, f. 8) prope, sed differt apice, et a laterale et vertice visum; etiam inter *C. javanicum* NORDST. (De Alg. nonn. p. 7, f. 10) et *C. Ralfsii d angulosum* RACIB. (Des. Krak. p. 15; Desm. Nov. p. 15, t. I, f. 6).

12. **C. Boldtii,** n. sp. C. minus, paullo longius quam latum, ovato-depressum; incisura mediana sub-profunda, lineari, extrorsum ampliata; semicellulæ sub-semicirculares, apice paullo depressæ; margine crenatæ; seriebus 5 verruculis conicis concentricis ornatæ; centro non tumescentes. Frons in centrali parte lævis.

Long. 14.5, lat. 12, lat. isth. 5 μ. T. VII, f. 24.

Clo. ROBERTO BOLDTIO hanc speciem dedicavi. *C. Haaboeliense* WILLE (Norg. Fersk. p. 25, t. I, f. 6) prope, sed differt in granulis, in margine, et semicellulis non tumidis.

13. **C. Regnellii,** WILLE (Sydam. Algfl. p. 16, t. I, f. 34) **formæ evolutæ.** Fere ut in f. typica, sed semicellulæ in centro paullo tumidæ, et papilla instructæ.

a. **major.** Long. 19, lat. 19, lat. isth. 6, cr. 8.5 μ. T. VII, f. 26.
b. **minor.** » 13, » 12.5, » » 4, » 5.7 μ. » » » 25.

Also WALLICH, Mscr. No. 153.

14. **C. noduliferum,** n. sp. C. parvum, late ovale, long. = $1^1/_2$-plo lat., incisura lineari, subbrevi, externe vix dilatata; semicellulæ sub-quadraticæ, angulis inferioribus sub-rotundatæ, superioribus rotundatæ, apice leniter rotundatæ; margine crenatæ; in centro semicell. granula (vel nodulus) unica, et in apicali parte rugositatem parvam (duabus gemmulis ornatam) habens. Membrana glabra.

Long. 21, lat. 14, lat. isth. 5 μ. T. VII. f. 27.

Forma *C. crenato* RLFS. proxima, sed differt in ornamentis atque insignis semicellularum.

15. **C. crenatum,** RALFS (Tr. Bot. Soc. Edin. v. 2, p. 151, t. 16, 1844; Br. Des. p. 96, t. XV, f. 7, 1848; non *Eu. crenatum*, NÄG.) **f. minuta.** Formæ typicæ consimile sed minus.

Long. 15, lat. 13, lat. isth. 5 μ. T. VII, f. 28.

16. **C. mordax,** n. sp. C. minus, ovale, quarta parte latius quam longum; sinu interno amplo, aperto, extrorsum constricto; semicellulæ dolabriformes; angulis basalibus productis, nasutis; apicibus rotundatis. Membrana lævis vel subtiliter punctata. A latere fere biglobulatum. Formæ suturæ et partium semicellularum adjacientium (a fronte) fere maxilliformes sunt; ex quo nomen.

Long. 31, lat. 42, lat. isth. 13 μ. T. VII, f. 29.
» 30, » 36, » » 9 μ. T, IX, f. 7.

Nearest to *C. pseudotaxichondrum* NORDST. (Alg. Brasil. p. 20, t. 2, f. 5, 1877; WOLLE, Desm. U. S. A. p. 71, t. L, f. 22, 23) but possesses none of the markings of that species, the granules being absent.

17. **C. Bissetii,** n. sp. Cos. mediocre, paullulum latius quam longum; semicellulis quadrato-depressis, angulis rotundatis, apicibus paullo incurvatis, sinu sub-lineari, extrorsum ampliato. Membrana achroa, centrali parte lævi, a fronte visa seriebus 11 radiantibus granulorum (in quaque circ. 6) ornata.

Long. 36, lat. 40, lat. isth. 14 μ. T. VII, f. 30.

Only one specimen of this pretty form was seen. In front view it is much like *Cos. Broomei* THWAITES (in RALFS' Br. Desm. p. 103, t. XVI, f. 6, t. XXXIII, f. 7), but the ornamentation is totally different.

I have much pleasure in associating the name of Mr. J. P. BISSET, a Scottish Desmidiologist, with this species.

18. **C. auriculatum,** REINSCH (Contr. Alg. p. 83, t. XIV, f. 5, 1875).

α. Long. 43, lat. 50, lat. isth. 17.5. Membrana punctata, non verruculosa; fusco-luteola. Forma paullo depressa. T. VII, f. 35; also WALLICH Mscr. No. 166, 167.

β. **verrucosum.** Long. 42—50, lat. 50—55, lat. isth. 21, crass. 22 μ. Membrana luteola; distincte verrucosa, verrucis concentrice ordinatis; angulis basalibus 4—5 spinulis armatis. T. IX, f. 8 a.

The segment marked 8 a¹ is punctate; perhaps young? This species is very common in Bengal; membrane always more or less coloured. There are two 'nuclei amylacei' in each semicell.

19. **C. pygmæum,** ARCHER (Descr. p. 174, t. VI, f. 45—49, 1864).

Long. 9, lat. 10, lat. isth. 3 μ. T. VIII, f. 17.
» 12, » 13, » » 5 μ. » » » 20.

This little form is perhaps nearest to ARCHER's own species *C. erosum* (sp. ined.), non DELPONTE No. 55, q. v.

20. **C. trinodiferum,** n. sp. Cos. minus; paullo longius quam latum; depresso-ovale; sinu lineari, æquale, extrorsum ampliato; semicellulæ cuneato-truncatæ, angulis inferioribus rotundatæ, dorso truncatæ. Membrana pro maxima parte lævis, sed sub-apicibus tribus nodulis (in triangulo positis), et apud margines utroque latere serie granulorum (circ. 5—6) ad basin diminuenda, ornata; marginibus minute crenulatis.

Long. 17, lat. 15, lat. isth. 5 μ. T. VII, f. 37.

Bengal; Northern India.

21. **C. ctenoideum,** n. sp. C. minus, ovale-depressum; paullo longius quam latum; semicellulæ cuneato-truncatæ, angulis inferioribus rotundatæ, apicibus paullo exsertæ; margine (lateris 3, apicis 5) crenatæ; sub utraque crena granula posita; membrana in aliis lævi; sinu lineari, extrorsum ampliato; apicibus truncato-crenatis. A vertice ovale, paullo ventricosum.

Long. 22—25, lat. 20, lat. isth. 6—7 μ. T. VII, f. 39, VIII, f. 59.

My friend Dr. NORDSTEDT asks »Are there not 2 granules at some of the crenæ, but not at all?» To this I may reply that the two figures are from distinct specimens, and are figured as I saw them. The species appears to be intermediate between *C. subcrenatum* HANTZSCH (in RABH. Alg. 1213; Fl. Eur. Alg. III, p. 164) and *C. subcostatum* NORDST. in N. et W. (Desm. et Œdog. p. 37, t. XII, f. 13); it is also near to *C. substriatum* NORDST. (W. et N. Alg. No. 977, 1889) but is without the extra granules at base, and the central nodule. 'Cos. sp.' WITTR. Gott. Öl. Sötv., t. IV, f. 15, is probably a *smooth* form of this species. In outline it much resembles it.

22. **C. centrosphinctum,** n. sp. C. sub-mediocre, circ. $1^{1}/_{2}$-plo longius quam latum; isthmo constricto, angusto; sinu amplo, interne rotundato; semicellulæ fere globosæ. Membrana glabra, sed apud apices ordine granulorum minutorum (granulis centralibus maximis) instructa; membrana achroa sed sæpe rubido-luteola. *C. moniliformi* (TURP.) RALFS proximum.

Long. 38, lat. 24, lat. isth. 6 μ. T. VIII, f. 1.

23. **C. circulare,** REINSCH (Spec. Gen. Alg. p. 113, t. 22 C. I, f. 1—4, 1867).

Long. 56, lat. 61, lat. isth. 26 μ.

Bengal; Central India; very common.

24. **C. corruptum,** n. sp. C. mediocre, polymorphum; paullo longius quam latum; semicellulæ ovatæ, plus minus altæ; angulis inferioribus late rotundatæ, dorso convexæ; isthmo modice constrictæ; sinu sublineari, extrorsum ampliato; membrana punctata, vel minute granulosa, achroa vel pallide fusco-luteola. A vertice visum compresso-ovale, apicibus paullo attenuatis, rotundatis; a latere fere biglobulatum. Zygospora globosa, dense aculeis longis obsessa.

Long. 48, lat. 44, lat. isth. 17—20 μ, cr. 22 μ. T. VIII, f. 2.
» 50, » 44, » » 18 » » 21—22 μ. T. VIII, f. 2 b.

C. circulari REINSCH (l. c.) et *C. scenedesmo* DELP. (Des. Sub-Alp. p. 101, t. VII, f. 28—34) intermedium.

Wallich, Mscr. No. 151; zyg. No. 149 (diam. zyg. 38, c. sp. 55 μ, fide G. C. W), T. IX, f. 40. It seems possible that this is identical with *C. phaseolus β stigmosum* Nordst. (Alg. N. Z. p. 59, t. 3, f. 14), which, with deference to Dr. N., I do not think is a var. of the said species — indeed, he himself appears to think that it is probably a separate species — it might stand as *Cos. stigmosum*, Nordst.

25. C. subcirculare, n. sp. C. mediocre; circ. tam longum quam latum; late ovatum; semicellulæ sub-semicirculares, basi rotundatæ, dorso sub-rotundatæ; isthmo modice constricto, sinu sub-lineari, extrorsum ampliato; membrana pallide fusca, subtiliter vel dense punctata, etiam rugosa (fere ut in *C. cyclico*, Lundell). A vertice visum ovale, apicibus sub-acutis; a latere ovato-truncatum, modice constrictum (semicellulis fere doliiformibus). Prope præcedentes, et *C. Lundellio*, Delp. (l. c. p. 109, t. VII, f. 62—64). Wallich, Mscr. No. 148.

α. Long. 58, lat. 56, lat. isth. 24, crass. 24 μ. T. VIII, f. 3 } IX, f. 27, 37.
β. **rugosum.** Long. 55, lat. 55, lat. isth. 24, crass. 36 μ. T. VIII, f. 7 }

Bengal; Central India.

26. Cos. sp. C. mediocre, paullo longius quam latum, late ovale; semicellulæ depresso-pyramidales, e basi magis angustatæ, dorso convexæ; sinu lineari extrorsum ampliato; membrana lævi?; angulis basalibus plus minus rotundatis. In sciagraphia habitu *C. Ralfsii* *c. montanum* Racib. (Des. Polon. p. 15, t. I, f. 4) sed duplo minus atque læve.

Long. 48, lat. 40, lat. isth. 18 μ. T. VIII, f. 4.

In all probability this is a form of *C. galeritum* Nordst. (Desm. Bras. p. 209, t. III, f. 26).

27. C. microsphinctum? Nordst. (in Nord. et Wittr. Desm. et Œdog. p. 33, t. XII, f. 9) forma **parvula.** Forma sinu profundiori et margine non ita regulari quam in f. typica.

Long. 26, lat. 15, lat. isth. 5 μ.

The membrane is smooth, and yellow-brown in colour. This may be intermediate between Nordstedt's sp. and the smaller forms of *C. ps.-granatum* Nordst. (Desm. Bras. t. III, f. 27).

Bengal; Central India.

28. C. quadrans, n. sp. C. submediocre, tam longum quam latum, quadraticum, semicellulæ depressæ quadratæ; angulis basalibus paullo, et superioribus magis, rotundatæ; sinu lineari, alto, externe ampliato; membrana paullulum incrassata, minute granulata. A vertice ovale.

Long. 28, lat. 28, lat. isth. 9, crass. 14 μ. T. VIII, f. 6.

29. C. octogibbosum (Reinsch) Nob. (Reinsch Contr. Alg. Prom. Bonæ Spei, p. 240, 1877; *Didym.* (*Cos.*) *Hammeri*, Reinsch, Alg. Frank. p. 111, t. X, f. 1, f. g. i. k.; Spec. Alg. p. 115, t. XXII, B, I, f. 13—19) *β* **Indica,** n. var. Ut in specie Reinschii, sed apicibus paullo productis, incavatis.

Long. 24, lat. 17, lat. isth. 5.5 μ. T. VIII, f. 8.

Under *C. Hammeri* (a. majus; b. minus; et c. octogibbosum), Reinsch has described 2 distinct forms; this resembles the latter, but is more elongate and a little larger — still it seems a cognate form. Cfr Reinsch in Linn. Soc. Journ. 1877, l. c.

— — **f. minor.** Long. 14, lat. 11, lat. isth. 3.5 μ. T. X, f. 14.
A little more than half the size of the larger form.
Northern India.

30. **C. Hammeri,** REINSCH (l. c., sub No. 29, t. X, f. 1, a—e, h; t. XXII B I, f. 1—12) **forma acuta.** Forma apice minus lata quam in f. typica.

Long. 28, lat. 21, lat. isth. 8 μ. T. VIII, f. 15.

Fortasse *E. retusi* PERTY (Bern. Mitth. p. 173, 1849; Kl. Lebensf. p. 208, t. XVI, f. 12, 1852) forma lævis?

F. typica, B. minus, REINSCH, l. c. Long. 17, lat. 13, lat. isth. 5 μ. T. IX, f. 34.
Northern India.

31. **C. vittatum,** n. sp. C. minus, late ovale, paullo longius quam latum; semicellulæ fere globosæ, paullo depressæ, lateribus totis rotundatæ; sinu lineari, extrorsum ampliato; apicibus depresso-rotundatis. Membrana (a fronte) seriebus verticalibus (vel vittis) 9, transversis 4, verrucarum ornata. A latere (et a vertice) non observatum.

Long. 23, lat. 20, lat. isth. 7 μ. T. VIII, f. 9.
Bengal; Central India.

32. **C. Willsianum,** n, sp. C. minus, ovale; vix $1^{1}/_{2}$-plo longius quam latum; semicellulæ compresso-reniformes, lateribus et apice rotundatæ; sinu profundo, lineari, externe ampliato; membrana a fronte visa, gemmulis sphæricis in seriebus verticalibus 5, transversis circ. 10, ornata, et basi serie (versus isthmum) in quaque semicellula verrucarum instructa. A vertice visum perfecte ovale.

Long. 33, lat. 25, lat. isth. 8 μ. T. VIII, f. 19.

The peculiar gemmulation with the basal series of elongate verrucæ separate this distinctly. I dedicate this to my friend A. W. WILLS, in token of esteem and of his work on the Desmidieæ.

This form somewhat resembles *C. tumidum* LUND., Desm. Suec. p. 45, t. III, f. 16, but differs in the granules being regularly disposed and in the vertical view not being centrally tumid; also in the basal verrucæ.

33. **C. homalodermum,** NORDST. (Desm. Arct. p. 18, t. VI, f. 4; *C. pyramidatum f. intermedia*, NORDST., Norg. Desm. p. 19) *β rotundatum* WILLE (Fersk. Nov. Semlja, p. 36, t. XII, f. 18) **forma.**

Long. 40, lat. 26, lat. isth. 8 μ. T. VIII, f. 23.

On this I observed no puncta, but they are often indistinct. The membrane is incrassate at apices.

Forma typica. Long. 55, lat. 44, lat. isth. 17 μ. T. VIII, f. 62. REINSCH (Alg. Prom. Bonæ Spei, p. 240, 1877) considers NORDSTEDT's species = *C. Hammeri B intermedium* ejus; the front view is certainly like, but the vertical and lateral views seem to me to separate these forms.

34. **C. isthmochondrum?** NORDST. (Norg. Desm. p. 12, f. 2) **β achondrum,** n. v. Var. minor, fere ut in f. typica, sed seriebus marginalibus 3 (non 2) granulorum ornata; centrali parte frondis (et isthmo) lævi, nullis granulis instructa.

Long. 23, lat. 18, lat. isth. 6 μ. T. VIII, f. 10.

This is near to but not quite the species referred to; possibly however an aberrant variety.

35. **C. apertum,** n. sp. C. submediocre, late ovale quinta parte latius quam longum; semicellulæ latissimæ flabelliformes, angulis basalibus subito rotundatæ, dorso late rotundo; sinu profundo, amplo, cuneiforme; membrana lævi. A vertice visum ovale.

Long. 30, lat. 37, lat. isth. 9 μ. T. VIII, f. 11.

C. tithophoro NORDST. (Alg. et Char. p. 6, t. I, f. 6) proximum, sed differt in medio semicellularum non protruso.

36. **C. bicrenatum,** n. sp. C. mediocre, tertia parte longius quam latum; late ovatum, sinu lineari, profundo, extrorsum ampliato; semicellulæ basi fere rectæ, apice rotundatæ, margine muricato-crenatæ; granulis marginem versus binatim positis ornatæ. Granula ad basin semicellularum in series 6 verticales disposita. *C. specioso* LUND. (Desm. Suec.) *α biformi* NORDST. (Desm. Spetsb. p. 30, t. VI, f. 11) proximum, sed minus et differt isthmo, forma semicellularum, et dispositione granulorum. A vertice visum ovale, tumore mediano truncato præditum: a latere ovato-lanceolatum.

Long. 44, lat. 32, lat. isth. 12, crass. 23 μ.

T. VIII, f. 13 (also WALLICH, Mscr. No. 136).

»The endochrome often sends off radiated processes, and then appears itself radiated. About 25 crenatures on each segment,» G. C. W., l. c. Dr. WALLICH's drawing shows 21 crenæ, mine only 17. There are 2 cell-nuclei (pyrenoïds) in each semicell.

37. **C. cycladatum,** n. sp. C. mediocre, tertia parte longius quam latum, late ovatum; semicellulæ semicirculares, sub-reniformes, margine granulo-crenatæ, granulis singulis marginem versus radiatim positis ornatæ, centro glabræ. Sinus linearis, profundus, extrorsum ampliatus.

Long. 44, lat. 30, lat. isth. 8 μ. T. VIII, f. 12.

C. specioso β simplici, NORDST. (Des. Spetsb. p. 31, t. VI, f. 12) proximum, sed differt forma semicellularum, et isthmo. [I fail to see why some authors have classed *C. speciosum* as a *Dysphinctium*, the sinus though shallow is *linear!*]

38. **C. punctulatum,** BRÉB. (Liste p. 129, t. I, f. 16, 1856) var. **depressum,** n. v. Semicellulæ (atque frons) depresso-ovales, lateribus rotundatæ, dorso leviter curvatæ; sinu sub-lineari, externe ampliato. Membrana concentrice granulata (non punctata ut in forma typica).

Long. 24, lat. 24, lat. isth. 8 μ. T. VIII, f. 16.

This is much like KLEBS' form (Desm. Ost. Pr. p. 37, t. III, f. 50, which is lat. and long. 28 μ, and is unlike the form of BRÉBISSON f. 51 l. c.

— — **forma β rotundatum,** KLEBS (l. c. f. 54). Specimina Indica paullo majora sunt; granulata.

Long. 40, lat. 34, lat. isth. 10 μ. T. VIII, f. 53.

REINSCH's form from the C. of Good Hope (Linn. Soc. Journ. XVI, t. VI, f. 7) is much like this, but smaller, 25 × 22 μ.

Var. Klebsianum (forma sub *β rotundatum* KLEBS, l. c. f. 52; l. 20, lt. 16 μ). Var. minor, compressa; apicibus rotundatis, cæteris ut in f. typica, sed granulata.

Long. 23, lat. 19, lat. isth. 8 μ. T. VII, f. 36.

The latter is so distinct from the type that it might, with propriety, be classed as a new species, *Cos. Klebsianum*, Nob.?

39. C. **exiguum,** Archer (in Q. J. Micr. Sci. p. 178, t. VI, f. 32, 33, 1864) f. **minor.** Forma minor, modice constricta, apicibus semicellularum perfecte semicircularibus.

Long. 21, lat. 11, lat. isth. 5 μ. T. VIII, f. 18.

The Indian forms are almost exactly those figured by Wolle (Desm. U. S. A., p. 66, t. XVI, f. 13, 14), having much more regularly rounded ends than in Archer's figure (a fronte).

40. **C. armillatum,** n. sp. C. minus, paullo longius quam latum; semicellulæ sub-reniformes, dorso valde convexæ; incisura mediana ampla, interne rotundata; membrana granulata, granulis in series verticales 4, transversas 10, ordinatis.

Long. 20, lat. 17—18, lat. isth. 6 μ. T. VIII, f. 22.

Near to *C. sphalerostichum* Nordst. *β Brasiliense*, Wille (Sydam. Algfl. p. 15, t. I, f. 30), and *C. orthostichum β pumilum*, Lund. (Desm. Suec. p. 25, t. II, f. 10), but differs in the very rotund semicells, the isthmus and the arrangement of the granules.

41. C. **Aitchisonii,** Schaarsch. (Afghan. Alg. in J. Linn. Soc., Bot., XXI, p. 246, t. V, f. 20. 1884; *C. monodentatum*, W. B. T. in litt. 1884).

Long. 30—33, lat. 21—23, lat. isth. 8. crass. 14 μ. T. VIII, f. 54.

Var. **punctatum.** Dense subtiliter punctata.

Long. 32, lat. 20, lat. isth. 8 μ. T. IX, f. 18.

In this species I find the apices often incavate, or sub-emarginate, as in fig. 54; in Schaarschmidt's form they are broadly rotund as in fig. 18.

The former might be considered to be a *Euastrum*, it might therefore stand as *Eu. monodentatum*, and the latter as *β punctatum* of *C. Aitchisonii.*

42. C. **bidentatum,** n. sp. C. parvum, sub-hexagonum, vix $1^{1}/_{2}$-plo longius quam latius; semicellulæ sub-trapezicæ, sursum angustatæ, dorso late rotundatæ, angulis inferioribus acuto-rotundatis vel rotundatis; sinu profundo, lineari, extrorsum ampliato; membrana lævi; semicellulis apicem versus dentibus conicis duobus munitis.

Long. 30, lat. 22, lat. isth. 6.5 μ. T. VIII, f. 24.

Nearest to the preceding species.

43. C. **laciniatum,** n. sp. C. parvum, circ. 5-ta parte longius quam latum, late ovale; semicellulæ rotundo-trapezicæ, basi dilatatæ, rotundatæ, apice truncatæ; incisura mediana profunda, lineari, externe ampliato; semicellulæ marginibus minute crenatis crenis 22—26; membrana achroa, medio lævi, margines versus seriebus duplicibus granulorum minutorum binorum concentrice positis (2 granula crenæ opposita). A latere et a vertice visa non observata.

Long. 17, lat. 14, lat. isth. 5 μ. T. VIII, f. 26.

44. **C. tenerum,** n. sp. C. minutum, fere longius quam latius, depressum; semicellulæ depresso-ovatæ, lateribus rotundatæ, dorso leviter convexæ; sinu lineari extrorsum ampliato; membrana achroa, apud margines serie granulorum (vel punctorum) minutorum instructa.

Long. 10, lat. 11, lat. isth. 5 μ. T. VIII, f. 27.

45. C. Jenisejense, Boldt (Sibir. Chloroph. p. 107, t. V, f. 13) **forma.**

Long. 30, lat. 33, lat. isth. 14 μ. T. VIII, f. 28.

Northern India.

It is a matter of much interest to find Siberian forms in India.

46. C. creniferum, n. sp. C. parvum, vix $1\,{}^{1}/_{2}$-plo longius quam latius, ovato-truncatum; medio modice constrictum, sinu lineari, extrorsum parum ampliato; semicellulæ pyramidato-truncatæ, angulis inferioribus rotundatæ, minute 5-crenatis; versus apicem attenuatæ crenam unicam ferentes; apice paullo protrusæ, minute 7—8-crenatæ; membrana granulis (margine angulorum basalium 3, apud crenam superiorem 1, et sub-apice 5 majoribus, et interne circulo 15—17 minorum granulorum, ornata; centrali parte frondis lævi.

Long. 23, lat. 18, lat. isth. 6 μ. T. VIII, f. 29.

Near to *C. alatum* Kirchn. (Alg. Schles. p. 153, No. 337), but differs in size, in the crenation and granulation of the semicells. Cfr No. 51.

47. C. munitum, n. sp. C. minus, sexta parte longius quam latius, late ovale; incisura mediana lineari, angusto, externe parum ampliato; semicellulæ late ovales; angulis inferioribus acute, et superioribus leniter, rotundatæ; apice leniter rotundatæ; margine laterum seriebus 5 (3 utroque latere a fronte) granulorum acuto-conicorum munitæ, et apicem versus tribus nodulis majoribus in serie appositis instructæ. In centro semicellulæ tumor parvus circulo granulorum (circ. 7, et 1 medio) ornatum. A vertice et a latere non visum.

Long. 31, lat. 25, lat. isth. 10 μ.

T. VIII, f. 30.

48. C. Bengalense, n. sp. C. mediocre, fere duplo longius quam latius, sinuate ovatum, medio modice constrictum, sinu lineari, angusto, externe ampliato, sæpe lineari-aperto; semicellulæ hexagonæ, lateribus bi-sinuatæ, usque ad ${}^{2}/_{3}$ longit., apicem versus attenuatæ, paullo incavatæ; apice truncatæ vel leviter rotundatæ; membrana achroa, glabra. A latere visum ovato-lanceolatum, semicellulæ lateribus medio fere planæ basi et apice contractæ, apicibus recto-truncatæ; incisura mediana amplissima.

Long. 68—76, lat. 32—44, lat. isth. 17—19, crass. 31 μ.

T. VIII, f. 33; IX, f. 33 (also in Wallich Mscr. No. 125).

»Endochrome in large granules from 2—6 μ in length and 2—3 μ broad, arranged somewhat in radii from a central point.» G. C. W. Nearest to *C. sub-quadratum* Nordst. (in Nordst. et Wittr. Desm. Ital. p. 32, t. XII, f. 7), from which it differs in outline, in the lateral view, and in being smooth, not punctate.

49. C. angulatum, (Perty) Rabenh. (Fl. Eur. Alg. p. 167; *Euastrum angulatum* Perty, Kl. Lebensf. p. 208, t. XVI, f. 11) **f. major** Grunow (Desm. Ins. Banka, p. 25, t. II, f. 24 a, b).

Long. 58—67, lat. 29—37, lat. isth. 16—18, crass. 23 μ. T. VIII, f. 35; IX, f. 25.

Grunow gives: Long. 62, lat. 40, lat. isth. 18 μ (a),
» 59, » 40, » 16 μ (b).

For the *type* Perty's dimensions are:

Long. 41, lat. 29, lat. isth. 16 μ.

Wallich (Mscr. No. 142) says: »In some matured specimens the endochrome was in large granular masses, measuring from 2.2 to 6.7 μ in length, and 2.2 to 4.5 μ in breadth, arranged in radii from a central point.» G. C. W., l. c. Whether this be correct or not, the specimen from which I figured f. 35 had remnants of endochrome shewing *two* pyrenoïds in each semicell, as depicted. WALLICH states that the ends are somewhat rounded, in my specimens one had straight, the others slightly incurved, apices. The frond is smooth.

50. **C. nigrocirratum,** n. sp. C. parvum, circ. $1^1/_2$-plo longius quam latius, late ovale; semicellulæ elongato-semicirculares, marginibus crenato-undulatæ, apice rotundatæ, apicem versus serie tumorum parvulorum circ. 7 (centralibus maximis) supra rugositatem fuscam vel nigrescentem posita, et in apice ipso granulis nigrescentibus 5 ornatæ; membrana reliqua lævi; sinu angusto-lineari, externe parum ampliato. A vert. et lat. non visum est.

Long. 33, lat. 23, lat. isth. 8 μ. T. VIII, f. 34.

The markings on this form are very peculiar, being so black in colour; those on certain *Xanthidia* are frequently bluish-black or dark purple by transmitted light, but these are much darker.

51. **C. alatum,** KIRCHN. (Alg. Schles. p. 153, 1878) **var. Indicum,** n. v. C. parvum, in aspectu a fronte maxime ut in f. typica, sed minus; semicellulæ basi inflatæ tri-crenatæ, supra attenuatæ sed crena magna protrusa preditæ; apice protrusæ; apicibus truncatis 5-crenatis; sinu lineari, sub-angusto; membrana verruculosa, verrucis concentrice ordinatis.

Long. 24, lat. 18, lat. isth. 7 μ. T. VIII, f. 36.

— — Forma. Apparently a small form of the typical outline.

Long. 22, lat. 20, lat. isth. 10 μ. T. VIII, f. 57.

52. **C. supergranatum,** n. sp. C. parvum, circ. $1^1/_2$-plo longius quam latum; semicellulæ rotundato-cuneatæ, lateribus rectæ vel paullo incavatæ; triangulares; angulis rotundatæ, apice sæpe truncato-rotundatæ; in centro tumore parvo (granulis circ. 9 granulos 3—4 cingentibus) preditæ, tumore raro carente; sinu profundo, lineari, extrorsum ampliato; membrana aut glabra aut punctata, vel ut supra ornamentata, raro glabra. A vertice visum modice ovale, centro tumidum; a latere ovato-lanceolatum, modice constrictum, apicibus rotundato-truncatis. (Rarissime semicellulæ glabræ, sed apicem versus semi circulo granulorum, circ. 6, ornatæ.) Habitu fere *C. granati*, BRÉB.

F. minor. Long. 25, lat. 16, lat. isth. 7 μ (ornatum). T. VIII, f. 37.
» **media.** » 30, » 20, » » 9 μ (punctatum). » 38.
» **pulchrum.** » 36—50, lat. 26—40, lat. isth. 8 μ, crass. 15—18 μ (glabrum et ornatum). T. IX, f. 24 (also WALLICH Mscr. No. 135).

This species seems to be very polymorphic as to its surface, its outline being fairly regular or constant. Nearest to *C. granatum* BRÉB. (in RALFS' Br. Desm. p. 96, t. XXXII, f. 6) and *C. pseudo-granatum* NORDST. (Desm. Bras. p. 211, t. III, f. 27).

53. **C. inane,** n. sp. C. minutum, circ. $1^1/_2$-plo longius quam latius, ovale, incisura mediana sublineari, aperto, externe ampliato; semicellulæ late ovatæ e basi dilatatæ, apice rotundatæ; membrana glabrà? A latere compresso-ovale, medio inciso, sinu cuneato, interne rotundato.

Long. 13, lat. 8, lat. isth. 3, crass. 6 μ. T. VIII, f. 41.

54. **C. melanosporum?** ARCHER (Mscr.) **forma orientalis,** n. f.

Long. et lat. 13.5, lat. isth. 5—6 μ. T. VIII, f. 43.

Mr. J. ROY kindly informs me that this is very near to Mr. ARCHER's species, which it is proposed to publish in the Scottish Desmidieæ by Messrs. ROY and BISSET.

55. **C. erosum,** ARCHER (Mscr.) non DELP. **forma minor.**

Long. 11, lat. 10, lat. isth. 2.5 μ. T. VIII, f. 44.

Also an unpublished species of ARCHER. Cfr remarks sub No. 54. I have a fig. of ARCHER's species, communicated by Mr. J. BISSET. As the name *C. erosum* has been otherwise appropriated, I trust Mr. ARCHER will re-name his Irish plant.

56. **C. pseudocoronatum,** n. sp. C. mediocre, paullo latius quam longum, depresso-quadraticum; semicellulæ depresso-quadraticæ, angulis basalibus parum rotundatæ, angulis superioribus rotundatæ, dorso leviter truncato-rotundatæ; basi ad apicem seriebus gemmulis conicis concentricis 6 ornatæ; cum pyrenoïdibus 2 in quaque semicellula; membrana achroa; sinu lineari, angusto, externe parum ampliato. A vertice ovale, non tumidum; a latere ovatum, modice constrictum, apice truncato-rotundatum.

Long. 46, lat. 48, lat. isth. 18 μ. T. VIII, f. 45.

The nearest species to this is *C. coronatum*, CKE. et WILLS (in Grevillea, IX, p. 90, 1880; WILLS, Desm. N. Wales, in Mid. Nat. IV, 1881, p. 74, t. V, f. 2), from which it differs in the superior angles being rounded, not sub-acute, and in having 6 rows, not 4, of granules; the Welsh species is also 1$^1/_2$ times larger.

57. **C. insigne,** n. sp. C. magnum, octa parte longius quam latius, depresso-biglobatum; semicellulæ depresso-rotundatæ, dorso late rotundatæ, membrana verruculosa, granulis magnis quincuncialiter ordinatis, et inter ea puncta minora æque ac in quincunce positis, apud basin seriebus duabus granulorum (vel punctorum?), circ. 13 in quaque serie; centrali parte frondis lævi; sinu ampliato, interne rotundato, brevi. A lat. et vert. non observatum.

Long. 75, lat. 62, lat. isth. 35 μ. T. VIII, f. 46.

Cfr Nos. 86 et 110.

58. **C. incavatum,** n. sp. C. parvum, longum æque ac latius, depresso-ovatum; sinu lineari, profundo, extrorsum paullum ampliato; semicellulæ depresso-ovales, apice truncatæ 6 crenatæ; margine irregulari, basali parte rotunda, dentibus 3 ornata; parte superiore lateris incavata, cum emarginatione unica bidentata; angulis superioribus singulatim dentatis; superficies frondis granulosa, granulis in series 4 concentrice ordinatis; utraque semicellula tumore verruculoso instructa.

Long. et lat. 22, lat. isth. 6 μ. T. VIII, f. 47.

β **planum.** Planum, vel levissime tumidum, in centr. inornatum.

Long. 22, lat. 20, lat. isth. 5 μ. T. XXII, f. 7.

Hab. *α* Bengal; *β* Khasia, G. VON L. legit.

59. **C. rotundum,** n. sp. C. mediocre, tam longum quam latum, late ovatum; modice constrictum, sinu sub-lineari, extrorsum ampliato; semicellulæ sub-semicirculares, basi rotundatæ, dorso late rotundatæ paullulum depressæ; ventre glabræ; membrana achroa, sub-crassa, marginem versus granulata, granulis in series regulares, concentricas, ordi-

natis (magnitudo granulorum major apud marginem). A fronte habitu prope *C. cyclico*, LUNDELL (Desm. Suec. p. 35, t. III, f. 6 e).

Long. et lat. 53, lat. isth. 28 μ. T. VIII, f. 48.

60. C. pseudoprotuberans, KIRCHN. (Alg. Schles. p. 150, No. 324; *C. polygonum forma* REINSCH, Contr. Alg. Fung. p. 89, t. IX, f. 5. non NAGELI) **forma.**

Long. 39, lat. 30, lat. isth. 8 μ. T. VIII, f. 49.

Hardly so angular as the type; membrane at the isthmus incrassate.

— — **f. typica.** Long. 41, lat. 36, lat. isth. 8.5 μ. T. X, f. 6.

About $^1/_7$th part larger than the German form, outline similar. Also WALLICH Mscr. No. 137. This sp. seems near to *Cos. sulcatum* NORD. (Alg. Sandv. p. 13, t. I, f. 18).

Tittaghur; July 1855, G. C. W.

61. C. scabrolatum, n. sp. C. submediocre, paullo longius quam latum, depresso-ovale; profunde constrictum, sinu lineari, angusto, externe parum ampliato; semicellulæ semicirculares, apice truncatæ 6-crenatæ, basi rotundatæ supra leniter attenuatæ; lateribus apud basin subito angulatæ, supra emarginationibus magnis circ. 4 instructæ; membrana in ventrem lævi, apud margines seriebus concentricis 4 granulorum, et subemarginationibus verrucis 4—5, etiam sub apice granulorum 6 (1 sub quaque crena), ornata. Specimen unicum observatum.

Long. 37, lat. 32, lat. isth. 11 μ. T. VIII, f. 50.

The lateral emarginations much resemble those in *C. quadrifarium* LUND. (Desm. Suec. t. III, f. 12), also the lateral verrucæ, but the rest of the semicells and the apices are wholly different, and the centre is (apparently) not tumid.

62. C. Portianum, ARCHER (Nat. Hist. Rev. Dubl. p. 19, t. I, f. 8, 9, 1860) f. **attenuata.** C. attenuatum; minor et gracilior quam f. typica.

Long. 32, lat. 24, lat. isth. 9 μ. T. VIII, f. 51.

63. C. triceps, n. sp. C. parvum, $1^1/_2$-plo longius quam latius; truncato ovale; medio molice constrictum; semicellulæ truncato-pyramidatæ, basi rotundatæ inde attenuatæ; apice truncatæ, angulis superioribus rotundatis; semicellulæ medio tumore (circulum granulorum circ. 7 ferente), et sub apice nodulis tribus, ornatæ; in cæteris membrana lævi. (Noduli apicales in rugositatem membranæ positi?). Sinus sub-brevis, parum apertus, extrorsum ampliatus. Cellula a fronte tantum observata.

Long. 32, lat. 24, lat. isth. 10 μ. T. VIII, f. 52.

Probably nearest to *C. Aitchisonii* SCHAARSCH. (Afghan. Alg. p. 246, t. V, f. 20), but differs in the central ornate inflation, and the apical nodules; it is also near to *C. armatum* JOSH. (Burm. Desm. p. 646, t. XXIV, f. 23, al. fig. excl.) from which it differs in the outline, the position of the nodules, the sinus, and the absence of lateral teeth.

64. C. Gangense, n. sp. C. minus, fere quarta pars longius quam latius, profunde constrictum; rotundato-quadratum; semicellulæ depresso-quadrangulares, basi subito et supra late rotundatæ, apice rotundato-truncatæ; margine crenato-undulatæ; membrana gemmulis conicis (in series 4 concentrice, singuli non tecte, positis) ornata; pars centralis frondis lævis; incisura mediana aperta, linearis, externe vix ampliata.

Long. 34, lat. 27, lat. isth. 10 μ. T. VIII, f. 55.

In size and arrangement of the gemmules near to *C. ps.-botrytis* GAY (Mon. Conj. p. 61, t. I, f. 18) but it differs much in outline; it is also closely related to the form described by KLEBS (Desm. Ost-Preuss. p. 39, t. III, f. 77) as a form of his *C. botrytis, var. A, forma c*, the true species of which is doubtful.

65. **C. peregrinum,** n. sp. C. sub-mediocre, 4-ta parte longius quam latius, late ovale, profunde constrictum, sinu aperto extrorsum fere clauso; semicellulis dolabriformibus, apice rotundatis. Membrana ventre semicellularum lævis, superiore parte et margine ordinibus curvatis sub-concentricis verrucarum (ordines 2 a fronte visæ) instructa.

Long. 35, lat. 40, lat. isth. 12 μ. T. VIII, f. 56.

C. cuneatum JOSH. (Burm. Desm. p. 647, t. XXIV, f. 17, 18) seems near to this, but it has only 2 rows of granules, while this has (a vertice) 3 rows of verrucæ, and is without marginal teeth.

66. **C. innotum,** n. sp. C. parvum, quarta parte longius quam latius, ovale, modice constrictum; sinu aperto, sub-lineari, æquale, extrorsum ampliato; semicellulæ semicirculares, basi modice rotundatæ. Membrana apud marginem seriebus duabus concentricis granulorum instructa, reliqua lævis.

Long. 21, lat. 16, lat. isth. 6.5 μ. T. VIII, f. 58.

67. **C. Arnellii,** BOLDT. (Sibir, Chloroph. p. 107, t. V, f. 15) **forma.**

Long. 55, lat. 47, lat. isth. 20 μ. T. VIII, f. 60.

The condensed chlorophyllaceous masses prevented a distinct view of the ventral part of the semicells, hence the superficial markings could not be delineated.

68. **C. scenedesmum,** DELP. (Desm. Sub-Alp. p. 101, t. VII, f. 28—34) **β punctatum.** In sciagraphia consimile, sed minus quam f. typica; membrana sparse punctata.

Long. 37, lat. 46, lat. isth. 17 μ. T. VIII, f. 61.

Very near to NORDSTEDT's *β dorsitruncatum* (Alg. N. Z. p. 59, t. 3, f. 15), but rather larger and not truncate on the upper margins.

69. **C. taxichondrum,** LUND. (Desm. Suec. p. 39, t. II, f. 13) var. **nudum,** n. v. Paullo depressum, minus longe sed latius quam f. typica, cui est consimile, sed angulis basalibus evolutis crassis, membrana lævi vel subtiliter punctata; granulis ornamentalibus carentibus. Nuclei amylacei bini.

Long. 40, lat. 43, lat. isth. 13 μ. T. VIII, f. 64.

The side view of a frond, long. 47, crass. 26 is shewn at f. 64*.

70. **C. obsoletum,** (HANTZSCH) REINSCH (*Arthr. obsoletus*, HANTZSCH in RABH. Alg. Eur. No. 1407, sec. LUND.; *Didym.* (*Cos.*) *obsoletum*, REINSCH Algfl. p. 110, t. IX, f. 5). Forma **major.**

Long. et lat. 64, lat. isth. 27 μ. T. VIII, f. 63.

This form agrees perfectly with those of Germany and Sweden.

LUNDELL (Desm. Suec. p. 38) says of the basal angles »modo non modo minus distincte acuminati sunt», and it is to be noted that he does not use the term »aculeati»: this testimony, and REINSCH's figure apparently exclude the basally dentiferous forms usually placed under this species. Cfr No. 71.

71. **C. palustre,** NOB. (*C. obsoletum* auctorum, non (HANTZSCH) REINSCH, nec LUNDELL, ut supra) **α circulare; β ovale.**

a. *α* **circulare, f. major.** Long. 65, lat. 65, lat. isth. 31 μ. T. VIII, f. 65.
b. » » **f. minor.** » 56, » 54, » » 22 μ. » IX, f. 29.
c. *β* **ovale.** » 68, » 78, » » 37 μ. » » f. 1.

Also in WALLICH Mscr. Nos. 170 and 281. »Endochrome collected into 2 irregular patches in each segment», G. C. W. These forms in front view are much like *C. Smolandicum* LUNDELL (l. c., p. 38, t. II, f. 17), but the vertical view is more acuminate and the lateral view not so deeply constricted as in LUNDELL's species. The form b, supra, is either smooth or delicately punctate. c shows the mucous investment; this fig. is after WALLICH. I certainly hold the opinion that these forms should not continue under *C. obsoletum*, as the basal angles are aculeate not acuminate.

72. **C. forte,** n. sp. C. mediocre, circ. quarta parte longius quam latius, longe ovale, profunde constrictum, sinu aperto, sub-lineari, externe parum aperto; semicellulæ fere semicirculares, basi acuto-rotundatæ; membrana percrassa, 2—3 μ crassitudine, modice punctata. Habitu fere *C. pachydermi*, KLEBS (Desm. Ost. Pr. p. 34, *'α typicum'*, No. 3, t. III, f. 36), non LUNDELLII (Desm. Suec. p. 39, t. II, f. 15) nec NORDSTEDTII, *v. minus*, (Norg. Desm. p. 18, f. 7).

Long. 65, lat. 52, lat. isth. 22 μ. T. VIII, f. 66.

The margin owing to the puncta appears striate; there are two amylum corpuscles in each semicell.

Northern India.

73. **C. rugosum,** n. sp. C. mediocre, longitudine circ. $1^{1}/_{8}$ latius; rotundo-ovale; semicellulæ late ovales, angulis rotundatæ, dorso leviter rotundatæ, apice non dilatatæ; sinu mediocre, lineari, extrorsum ampliato; membrana rugosa, nodulis in series (13—14 rectas verticales, et circ. 9—10 transversas) ordinatis; centro juxta isthmum læve. A vertice visum ovale.

Long. 60, lat. 45, lat. isth. 17 μ. T. VIII, f. 67.

Nearest to *C. conspersum* RALFS (Br. Desm. p. 101, t. XVI, f. 4) but although the vertical view is much similar, the front view is very different, having broadly-rounded angles at base and the end, which is not dilated (as in *C. conspersum*) but simply rotund.

74. **C. præcelsum,** n. sp. Cos. submediocre, tam longum quam latum, circulare; semicellulæ paullo dolabriformes, dorso rotundatæ; (angulis inferioribus protractis, dejectis,) margine crenato-gemmulatæ; sinu cuneato, extrorsum fere occluso vel constricto; membrana verrucosa, nodulis ovalibus in series (6 laterales et 12—13 rectas verticales) ordinatis; media parte frondis, juxta isthmum lævi. A vertice et a latere non observata.

Long. 48, lat. 46, lat. isth. 13 μ. T. IX, f. 2.

75. **C. Sikhimense,** n. sp. C. sub-mediocre, vix latius quam longum, a fronte bi-ovatum; semicellulæ ovales, dorso leniter depressæ; lateribus angulato-rotundatis, e sinu curvatis, margine integris; incisura mediana brevi, aperto, externe ampliato; membrana sparse granulosa, apud marginem seriem nodulis conice-acutis (maximis apicem versus) prædita. A latere visum modice constrictum, sinu rotundato, semicellulæ fere globosæ.

Long. 47, lat. 42, lat. isth. 18, crass. 25 μ. T. IX, f. 4, 36. Northern India.

76. C. striatum, Boldt. (Sibir. Chloroph. p. 104, t. V, f. 9) f. **Indica.** Fere ut in f. typica, sed lateribus supra basin fere rectis, dorso indistincte 4—5 crenato; striæ apicales indistinctæ.

Long. 15, lat. 12, lat. isth. 4 μ. T. IX, f. 6.

This is near to, but smaller than, *C. striatum v. glabratum* Rac. (Des. Nov. p. 9, t. V, f. 31), but, as in the form from Lübeck, the striæ are very faint.

77. C. perizosmum, n. sp. C. parvum, vix tertia parte longius quam latum, late ovale; semicellulæ plus minusve ovato-depressæ, lateribus e basi plus minus rotundatæ, apice depresso-rotundatæ; membrana marginem versus granulata, lateribus ordinibus tribus granulorum concentrice positis instructa, (ordine interiore semi-circulariter continuata), apicem versus granulis circ. 4, centralibus maximis, ornata; sinu lineari, extrorsum ampliato. A vertice visum ovale.

Long. 22, lat. 17, lat. isth. 6 μ. T. IX, f. 12.

β ornatum. Fere ut supra, sed ordo interior granulorum non continuata, apicem versus interrupta; semicellulæ ventro paullo tumidæ, granulis 6—7 gregariter positis ornatæ.

Long. 21.5, lat. 18, lat. isth. 6 μ. T. IX, f. 13.

This is somewhat like the form represented in T. VIII, f. 10, but that has only 2 marginal granules larger than the rest, and only 2 series.

78. C. concentricum, n. sp. C. minus, circ. $1^1/_3$-plo longius quam latius; longe ovale; valde constrictum; semicellulæ depresso-ovales, basi dilatatæ, angulis basalibus acute-rotundatis, apice paullo rotundatæ, apicem versus leviter attenuatæ; sinu profundo, aperto angusto-triangulari, extrorsum valde ampliato; membrana rugosa, ordinibus 6—7 in quaque semicellula granulorum concentrice dispositis instructa.

Long. 23, lat. 18, lat. isth. 7 μ. T. IX, f. 11.

Nearest to the small forms of *C. punctulatum*, Bréb.: possibly the same as *C. orbiculatum* Delp. (Desm. Sub-alp. p. 107, t. VII, f. 46) nec Ralfs!

79. C. sp. C. minus, late ovale, paullo latius quam longum; semicellulæ late ovales, marginem versus ordine granulorum (granulis apicalibus maximis) instructæ, ventre læves, reliqua parte minute granulatæ; sinu angusto-lineari, profundo, extrorsum ampliato.

Long. 20, lat. 18, lat. isth. 7 μ. T. IX, f. 10.

I am in doubt as to placing this form; it is undoubtedly near to *C. perizosmum* No. 77; possibly it might stand as var. γ *granulatum* of that species.

80. C. cuneatum? Josh. (Burm. Desm. p. 647, t. 24, f. 17, 18) var. **Indicum.** Marginibus e basi dentatis; centro nudo; apicibus crenato-truncatis.

Long. 39, lat. 45, lat. isth. 11 μ. T. IX, f. 14.

This is rather hard to identify, as Mr. Joshua's figures are both obliquely drawn (f. 18 much so); the var. is more depressed than the type, without the central granules; with semicells dentate from the basal angles upward to the apices, which are crenato-truncate.

Central India.

81. C. ptilotum, n. sp. C. mediocre, quinta parte longius quam latius, depresso-ovale, semicellulæ depresso-ovatæ, lateribus rotundatæ, tota margine (ut mihi videtur) crenato-undulatæ (dorso sub-truncatæ, medio paullo tumidæ); membrana achroa, marginem versus verrucis sub-quadraticis, circ. 18 in quaque semicellula, et centro granulis circ. 7 annulo dispositis, 2—1 granulis cingentibus, ornata. Sinu profundo, sub-lineari, extrorsum ampliato. A vertice ovale, centro paullo tumidum.

Long. 54, lat. 43, lat. isth. 12 μ. T. IX, f. 17.

Probably nearest to the form of *C. Ungerianum* (NÄG.) ARCHER described by REINSCH (Contr. Alg. Fung. p. 84, t. XVI, f. 6) as *Cos. oligogongrus*; it is also close to *C. gemmatum*, NOB. (On Desm., p. 935, t. XVI, f. 5), [which is not, pace WOLLE = *C. triplicatum* ejus (Desm. U. S., t. XIX, f. 3—6), as the centre of semicell is *doubly* tumid; cfr his f. 6, basal view of conjugating semicell!]; and to *C. nodosum*, ANDERSSON (Chloroph. Roslag. p. 14, f. 8). From all these it differs in many points of detail. That acute observer Dr. O. NORDSTEDT asks, in litt., »Are the crenæ at the margin really such as in the inner series?» I think not, the marginal elevations being rounded at apex, while the infra-marginal verrucæ are distinctly truncate or rotundato-truncate at their apices.

Northern India.

82. **C. subquasillus,** BOLDT. (Desm. Grönl. p. 25, t. I, f. 25) var. **tropicum,** n. v. C. ovato-depressum, paullo longius quam latum; semicellulæ cuneato-depressæ, marginem versus ordinibus 4 granulorum radiatim (usque ad 30 series) positis; centro tumido granulis magnis et parvis irregulariter sparso. Paullo minor quam f. typica.

Long. 64, lat. 60, lat. isth. 18 μ. T. IX, f. 15.

In the typical form the radiating granules form about 20 series, the size being equal; in this there are about 30 series, increasing in size from the interior to the margin; the mixture of large and small granules in the centre is noteworthy.

Central India.

83. **Cos. sp.** C. *Cos. lævi* RABH. (l. c.) propius, sed glabra.

Long. 23—29; lat. 22—26; lat. isth. circ. 10, crass. circ. 14 μ. T. IX, f. 16

About twice the size of No. 7; membrane smooth. WALLICH Mscr. No. 126, from which the figure is taken.

84. **C. Tittaghurense,** n. sp. C. minutum; ovale, fere latum quam longum; semicellulæ acuto-ovales, latere acuto-rotundatæ; membrana lævis; sinu aperto, externe ampliato Semicellulæ a vertice ellipticæ; a latere fere orbiculares, incisura mediana late incurvata Zygosporæ glabræ, orbiculares, membrana crassa.

Long. 13, lat. 12, lat. isth. 3, crass. 8, diam. zyg. 13 μ.

T. IX, f. 19 (after WALLICH Mscr. No. 165).

Apparently between *C. tinctum*, RALFS and *C. bioculatum*, BRÉB., from which i is separated by the acuto-rotundate sides, the sub-triangular sinus, and the globos zygospore.

Tittaghur.

85. **C. medioglabrum,** n. sp. C. minus, circ. quarta parte longius quam latum, angulato ovatum; semicellulæ sub-hexagonæ, angulis modice rotundatæ, margine acute crenatæ apice truncato-crenatæ; membrana in centralem partem frondis glabra, latera versu subtiliter granulata; sinu lineari, æquale, extrorsum ampliato. A vertice visum ovale

Long. 18, lat. 14, lat. isth. 4 μ. T. IX, f. 20.

This seems nearest to *C. laciniatum*, No. 43, from which it differs in the sides being sub-rotund or somewhat acute, and in the granules being scattered, not concentrically arranged.

86. **C. paradoxum,** n. sp. C. sub-magnum, quarta parte longius quam latius, rotundatum; semicellulæ late ovales, lateribus rotundatæ; membrana juxta isthmum lævi, in superiorem partem 9—10 ordinibus granulorum obliquiter, vel in heptuncem, dispositis. Sinu aperto, interne rotundato, amplo, extrorsum rotundato. A vertice visum late ovale.

Long. 80, lat. 60, lat. isth. 34, cr. 44 μ. T. IX, f. 22.

Near to *C. insigne*, supra, but in this form the granules are closer in apposition than in No. 57, and, moreover, in each transverse series there are 15—17 large granules, while in the other there are only 8—10 in each row, also vertically there are the same number of rows in both. The semicells, in *C. insigne*, are more globular in in front view than in this form.

87. **C. Norimbergense,** Reinsch (Alg. Frank. p. 113, t. IX, f. 2) var. **microscopicum** (*C. microscopicum* W. B. T. in litt.). Var. minutum, fere ut in f. typica, sed apicibus paullo attenuatum.

Long. 8, lat. 5.5, lat. isth. 2 μ. T. IX, f. 28

This little form does not vary greatly in size, and is frequent in British gatherings.

— — **forma?** Long. 12, lat. 8, lat. isth. 2.5 μ. T. IX, f. 43.

Probably related to this species.

88. **C. staurochondrum,** Lemaire (Desm. Vosges. p. 20, t. I, f. 1) var. **orientale.** Forma typica differt apicibus non prolongatis, utroque latere apicum dente brevi munita, 'stauros' granulorum non centrale sed apicali, et apicem versus sine granula minora.

Long. 26—40, lat. 22—34, lat. isth. 7—11 μ. T. IX, f. 23.

C. gemmatum var. β, Wallich Mscr. No. 129.

89. **C. proteiforme,** n. sp. C. variabile, circ. $1^1/_2$-plo longius quam latius, ovatum; semicellulæ ellipticæ; membrana glabra, punctata, vel minute granulata!, sinu aut lineari aut valde æquale aperto, externe ampliato; isthmo brevissimo, vel collo parvo simili (usque ad $^1/_{14}$ parte longius). A vertice visum ovale; a latere biglobulatum, subprofunde constrictum) fide Wallich Mscr. No. 138).

Long. 21—42, lat. 14—29, lat. isth. 6—8, crass. 16 μ (G. C. W. l. c.).

The form in which the isthmus is prolonged into a short neck Dr. Wallich styles a var.; this might be var. *β* **Wallichii.** It is to be noted that this lengthening of the isthmus regularly occurs in certain Indian forms, in this and other genera.

T. IX, f. 26.

90. **C. sexangulare,** Lund. (Desm. Suec. p. 35, t. II, f. 23) var. **Bengalense.** C. minus quam f. Suecica; angulis lateralibus sub-acutis, dorsalibus fere obliteratis; sinu profundo, isthmo contracto; a latere et a vertice visum angustius quam f. typica.

Long. 22—37, lat. 18—27, lat. isth. 5.5—8, crass. 13—20 μ. T. IX, f. 30.

91. **C. æquale,** n. sp. C. sub-mediocre, 5-ta parte longius quam latius, obtuse sexangulare; semicellulæ rotundo-triangulares, basi et apice rotundatæ, medio paullo tumidæ, lateribus in superiore parte paullo incavatis; membrana glabra; sinu profundo, angustissimo,

externe ampliato. A latere visum bi-globulatum; a vertice ovato-fusiforme, lateribus in medio tumidis, apicem versus paullo incavatis.

Long. 29—45, lat. 24—37, lat. isth. 7—10. crass. 17—25 μ. T. IX, f. 31.

Near to *C. granatum* DELP. (p. 107, t. VII, f. 46—48) in Desm. Sub-alp. (non auctorum) but differs from this in side and end aspects. Also WALLICH, Mscr. No. 157.

92. **C. scabrum,** n. sp. C. mediocre, fere tam longum quam latum, quadraticum; semicellulæ parallelogrammiformes; angulis parum rotundatis, (lateribus et apice fere rectis), apicibus truncatis; sinu profundo, lineari, angusto, extrorsum parum ampliato; membrana dense verrucosa, scabra; granulis in exteriorem partem parum radiatim positis, quumque laterum versus conglomeratis, 'rosettas' efficientibus, instructa. Pars centralis frondis juxta isthmum lævis. A lat. et a vert. non observatum.

Long. 49, lat. 52, lat. isth. 20 μ. T. IX, f. 32.

93. **C. orientale,** n. sp. C. sub-mediocre, quinta parte longius quam latius; late pyramidatum; semicellulæ rotundo-triangulares, basi et apice rotundatæ, medio non tumidæ, lateribus supra basin paullo incavatis; sinu brevi, lineari, externe valde ampliato; membrana glabra. Corpora amylacea dua in quaque semicellula. A vertice visum ovale: a latere ovato-lanceolatum, medio vix constrictum.

Long. 43—65, lat. 36—55, lat. isth. 18—26, crass. 18—28 μ. T. IX, f. 35.

94. **C. Raneegungense,** n. sp. C. minus, circ. $1^{1}/_{2}$-plo longius quam latius; semicellulæ rotundato-triangulares, angulis rotundatæ, lateribus incavatæ; sinu lineari, profundo, angusto, externe ampliato; membrana glabra aut subtiliter punctata. A vertice visum ovale; a latere lanceolatum, modice constrictum, apice rotundatum, apicem versus lateribus incurvatis. Zygospora sphærica, mediocris, superficie cum multis prominentiis rotundatis plena, circ. 9 apud marginem visis. Raro semicellulæ paullo in centro tumidæ, annulum granulorum ferentes (**β ornatum**). [Forsan *C granatum* DELP. (Desm. Sub-alp. p. 100, t. VII, f. 16—21) non BRÉB. nec auct.]

α et β. Long. 25—32.5, lat. 19—24, lat. isth. 6—8.5, crass. circ. 16, diam. zyg. 29 μ. T. X, f. 13.

From Dr. WALLICH's sketch, Mscr. No. 131, there appears to be but one amylum corpuscle in each semicell. Dr. W. says that the conjugating fronds assume the apposition shown in a and a'. The mature zygospore is reddish-brown in colour.

95. **C. dulciferum,** n. sp. C. submediocre, tam longum quam latum, truncato-ovatum; semicellulæ late flabelliformes; angulis basalibus sub-truncatis, lateribus sinuato-inclinatis, apicibus truncatis; membrana granulata, margine series 6—7 concentricas granulorum minutorum prædita, in centro cujusque semicellulæ tumore parvulo, annulo granulorum ornato, instructa. Sinus apertus, amplus, triangularis, profundus. A vertice visum lanceolatum, apice truncatum, modice constrictum; semicellulis truncato-ovalibus — a vertice lanceolatum, medio truncato-tumidum, verticibus truncato-rotundatis. Corpora amylacea singulatim locata.

Long. 39—42, lat. 40, lat isth. 13, crass. 20—21 μ. T. IX, f. 39.

This form in WALLICH Mscr. No. 189, is named *Euastrum anceps*, but as it is not a *Euastrum*, and as LUNDELL has appropriated the specific name, this falls. It seems near to the little »Cos. sp.» Reinsch (Alg. et Fung. p. 83, t. XVI, f. 9), but is much larger and also ornate.

Mungulpore, 3 Nov. 1855; rare. G. C. W.

96. C. scutellum, n. sp. C. submediocre, tam longum quam latum, depresso-ovale; semicellulæ fere semicirculares, apice paullo depressæ, lateribus e basi rotundatæ, margine sinuato-crenatæ; membrana subtiliter punctata, marginem versus verrucis (circ. 18 in quaque semicellula) prædita; sinu lineari, angustissimo, profundo, externe vix ampliato. Nuclei amylacei bini (sec. cl. Wallich delineati).

Lat. et long. 37—44, lat. isth. 11—13 μ. T. IX, f. 38 (after Wallich, Mscr. No. 133).

97. C. pseudo-Broomei, Wolle (Desm. U. S. Amer., p. 86, t. LI, f. 36, 37).

Long. 33, lat. 29, lat. isth. 12, crass. 16 μ (Wallich, Mscr. No. 145).

T. IX, f. 41.

»Fronds varying from the extreme quadrangular shape figured, to orbicular, or nearly so. Side view, segments orbicular, somewhat compressed (occasionally) at centre of segments, ends rounded. End view linear, ends suddenly truncate and flattened in the quadrangular varieties.» G. C. W. I have never seen any variation in this species except that sometimes the superior angles are much more rounded than at others. The arrangement of the granules is much like that in *C. reniforme* (Ag.) Arch. *β compressum* Nordst. (Alg. N. Z. t. V, f. 5), cfr No. 137.

98. C. impressulum. Elfving (Finska Desm. p. 13, f. 9); *C. Meneghinii forma* Reinsch (Contrib. p. 88, t. XII, f. 12 a); vix De Bary (Conj. t. VI, f. 34); idem *forma d* Boldt (Desm. Grönl. p. 13) f. **minor:**

Long. 16, lat. 12, lat. isth. 4.5 μ. T. IX, f. 42.

99. C. moniliforme, (Turp.) Ralfs (Br. Desm. p. 107, t. XVII, f. 6; *Tessarthronia moniliformis*, Turp. Mém. du Mus. XVI, p, 310, t. XIII, f. 18; Dict. Sci, Nat. Veg. Acotyl, t. VII, f. 1; *Tessararthra moniliformis*, Ehrb. Abh. 1835, p. 173; Inf. p. 145, t. X. f. 20; etc.) formæ:

Long. 26, lat. 15, lat. isth. 2 μ W. B. T.
» 27, » 16, » » 5 » »
» 23, » 11, » » 3 » G. C. W. 2.
» 23, » 12, » » 5 » » 1.

T. IX, f. 44, 45 (also Wallich, Mscr. No. 140, 1 and 2).

Hab. 1. Raneegunge, July 1855; 2. Mungulpore.

100. C. pulchellum, n. sp. C. mediocre, circ. sexta parte longius quam latius, depresso-ovatum; semicellulæ rotundato-quadraticæ, angulis totis rotundatis, ventre paullo tumidæ, dorso leviter truncato-curvatæ; membrana granulata, excipe partem juxta isthmum, granulis in lineas obliquas (dextr. et sinistr.) in heptuncem ordinatis, lineis in max. diam. circ. 16; sinu lineari, angusto, parum profundo, extrorsum ampliato. A latere visum late bi-ellipticum; a basi visum rotundato-quadraticum, lateribus et apicibus rectis, angulis rotundatis; granulis radiatim dispositis. Nuclei amylacei bini.

Long. 46, lat. 39, lat. isth. 13. crass. 24 μ. T. IX, f. 46

Near to *C. ps.-Broomei* Wolle (cfr No. 97) but differs in the far greater number of lines of granules, the granules themselves being much smaller than in that species. *C. margaritiferum?* Wallich Mscr. No. 146 A.

101. **C. tetrophthalmum,** Kütz. (*Pandurella tetrophthalma* Ktz. in litt. apud Mengh.; *Heterocarpella tetrophthalma* Ktz. Synops. p. 597, f. 87; *Euastrum tetrophthalmum*, Ktz. Phyc. Germ. p. 136; *Cosmarium tet'm* Bréb. in litt. 1846) **formæ Indicæ:**

a. Long. 96, lat. 64, lat. isth. 23 μ. T. IX, f. 47.
b. » 59, » 39, » » 13 » Wallich, Mscr. No. 150.

Hab. a. Northern India, Sikhim?; b. Bengal, G. C. W.

102. **C. sp.** (*conspersum? C. consperso* Ralfs, *β rotundato* Wittr., accedens).

Long. 50, lat. 43, lat. isth. 13 μ?? Wallich Mscr. No. 146 B. *Forma monstrosa*, apud cl. Wallich; facsimile. T. IX, f. 48.

I am not at all sure of these *dimensions*, as no data are appended to Wallich's sketch. The monstrosity is very peculiar, in fact unique, the two subsidiary segments proceeding at right angles from the side portions of the central frond. The general appearance of the central frond is much like Wittrock's var. in Skand. Desm. f. 4.

C. conspersum Ralfs *β rotundatum* Wittr., **f. Boldtii,** Nob. (»forma» Boldt, Desm. Grönl. p. 26, t. II, f. 27, 1888).

A form exactly like this appears from the Himalayas (ex *Utricularia stellari*, comm. G. v. L.); it is a little smaller than the Greenland form. long. 65—68, lat. 46—49 μ. Two specimens observed.

103. **C. spiculiferum.** n. sp. C. minus, tertia parte longius quam latum; angulato-circulare; semicellulæ indistincte 9-gonæ, dorso elliptico-pentagonæ, lateribus bi-angulatæ; angulus unusquisque spiculo brevi unico munitus, sed angulus apicalis tuberculos duos breves conicos præbet; in centro quaque semicellula tuberculos parvos duos habet, ventre semicellularum inflato; reliqua membrana lævi; sinu profundo, angusto, externe non ampliato. A latere visum paullo constrictum, semicellulæ angulato-ovales; a vertice elongato-truncatum, quasi 6-angulatum; angulis medianis indistinctis.

Long. 27—40, lat. 22—31, lat. isth. 10—14, crass. 16—18 μ. T. IX, f. 49.

C. gemmatum (type) Wallich, Mscr. No. 139. Nearest to *C. Warmingii* Börg. (Des. Bras. t. IV, f. 34) but is much more angular.

104. **C. Indicum,** n. sp. C. minus, tam latum quam longum, sub-circulare; semicellulæ dolabriformes, dorso semicirculares, basi rostratæ, productæ, dejectæ; margine crenato-granulatæ; membrana granulosa, tumorem centralem annulo granulorum (6—7) ornatum habens; sinu amplo, sub-profundo, triangulari, extrorsum constricto fere occluso: apicibus semicellularum dentibus erectis 4 armatis. A vertice visum oblongo-truncatum, medio tumidum; a latere mediocriter constrictum, sinu rotundato, semicellulæ globosæ apice truncatæ.

Long. et lat. 22, lat. isth. 12, crass. 15 μ. T. IX, f. 50 (also Wallich Mscr. No. 279).

From Wallich's drawing it appears that each semicell contains two amylum corpuscles. It seems closely related, in general outline, to *C. rostratum* Turner

(Some Desm. p. 935, t. XVI, f. 6), but differs therefrom in the basal angles, membrane and tumidity, isthmus and sinus.

105. **C. gradatum,** n. sp. C. submediocre, paullulum latius quam longius, late ovale; semicellulæ late flabelliformes, centro tumidæ, dorso semicirculares, angulis basalibus subrectæ; margine emarginato-incisa (vel in rugositatibus latis secta — circ. 16), emarginationibus ipsis plerumque incisis; membrana glabra; sinu profundo, angusto-cuneato. A vertice visum acute-ovale, centro tumidum; a latere modice constrictum, semicellulæ longe ovales, medio tumidæ, verrucibus conspicientibus »*gradatim*» ordinatis (ex quibus nomen speciei). Zygospora globosa, processubus longis ad apices trifidis (apud marginem circ. 12) armata.

Long. 44, lat. 47, lat. isth. 11, crass. 19; zyg. diam. s. acul. 27, c. acul. 44 μ. T. X, f. 1 (also WALLICH Mscr. 269; zyg. No. 276).

In this species the apex is *sometimes* sub-truncate.

106. **C. depressum,** (NÄG.) LUND. (*Euastrum* (*Tetracanthium*) *depressum*, NÄGELI, Einz. Alg. p. 114, t. VII c, f. 2; *Cos. depressum* LUND. Desm. Suec. p. 38; non BAILEY) var. **granulatum.** Parvum, magis depressum, superficies minute granulata (sec. WALLICH Mscr. No. 155).

Long. 20.5, lat. 25, lat. isth. 6 μ. T. X, f. 3.

Smaller and more depressed than the type. »Covered with very delicate tubercles (granules) which give a rough appearance to the edge», G. C. W.

α typica. I have the typical form of *C. depressum*; comm. G. v. L., from Khasia, upon the river Brahmaputra (ex *Utricularia sp.*), and from East Bengal (ex *Utr. flexuosa*); both from the Stockholm Museum.

107. **Cos. sp.** (*C. punctulato* BRÉB. accedens) *forma monstrosa.*

T. IX, f. 52 × 600, after WALLICH Mscr. No. 152, facsimile.

This very curious monstrosity has two aborted cells proceding from the dexter and sinister sides of the isthmus of a normal semicell.

108. **C. Barrackporeanum,** n. sp. C. submediocre, tertia parte longius quam latum; clepsydriforme; semicellulæ late ovatæ, e basi leniter dilatatæ, apice rotundatæ, margine crenato-undulatæ; membrana juxta isthmum lævi, in superiore parte semicellularum seriebus tribus granulorum concentrice ordinatis instructa; sinu valde aperto, brevi, rotundato, extrorsum amplissimo. A latere visum fere ut a fronte sed paullo compressum.

Long. 42, lat. 31, lat. isth. 16, crass. 24 μ. T. X, f. 4.

Barrackpore.

109. **C. occidentale,** NOB. (*C. gemmatum*, TURNER, Some Desm. p. 935, t. XVI, f. 5 — non *Cos.* (*Eu$^{\underline{m}}$*) *gemmatum* (BRÉB.) KTZ., RALFS' Br. Desm. p. 87) **var. ornatum,** n. v. C. cum duabus (non tribus) seriebus granulorum marginalium, et ventre semicellularum cum granulis vel nodulis in lineas duas (circ. numero 3 et 4) concentrice positis ornato; reliqua ut in f. typica.

Long. 46, lat. 42, lat. isth. 18 μ. T. X, f. 5.

My friend Dr. NORDSTEDT has suggested that, to avoid confusion, it will be well to change this name; I do so accordingly. Cfr note under No. 81, a species some-

110. **C. bacciferum,** n. sp. C. submagnum, circ. $1^1/_2$-plo longius quam latius, ovale; semicellulæ late ovales, angulis basalibus aut rotundatæ aut sub-acutæ, apice rotundatæ; membrana tenui, nodulis magnis in series obliquas ordinatis (unumquaque in centro maculam habens), prædita, et inter nodulos bacciformes modice punctata. A fronte series nodulorum circ. 10. A vert. et a lat. non observatum. Sinu cuneato, modice aperto.

Long. 74, lat. 52, lat. isth. 20 μ. T. X, f. 8.

Cfr *C. insigne*, No. 57.

111. **C. macrosporum,** n. sp. C. minutum, circ. $^1/_2$-plo longius quam latum, sub-quadraticum; semicellulæ depresso-quadratæ, basi rotundatæ, lateribus et apice paullo incurvatæ; angulis superioribus cæsis; in centro tuberculo parvo instructæ, paullo tumidæ; membrana glabra; sinu angusto, lineari, externe parum ampliato. A latere visum semicellulis pyriformibus; a vertice ovale. Zygospora magna, sphærica; membrana iniqua, crassa.

Long. 13, lat. 9, lat. isth. 4.5, crass. 6, diam. zyg. 19.5 μ. T. X, f. 11 (and Wallich Mscr. No. 161).

»Sporangium orbicular, surface somewhat uneven, central mass pale green, radiate. The capsule of a pale reddish yellow,» G. C. W. This zygospore in size is somewhat near to that of *C. melanosporum* Archer (sp. ined., fide J. Roy in litt. c. ic.), but the frond differs. Cfr No. 54 supra.

112. **C. rectosporum,** n. sp. C. minus, circ. sexta parte longius quam latius, truncato-ovatum; semicellulæ truncato-pyramidatæ, lateribus et angulis rotundatæ; membrana glabra; sinu angusto, lineari, extrorsum parum ampliato; a vertice visum compresso-ovale. Zygospora magna, quadratica, angulis rotundata; membrana crassa.

Long. 29, lat. 24, lat. isth. 5 (usque ad 3.5), crass. 12, lat. zyg. 28 μ. T. X, f. 16 (sec. Wallich Mscr. No. 164).

The quadrate zygospore is very curious. Wallich says of it — »Enclosed with the segments in a common mucous matrix. *Four* fronds seem concerned in the formation of this one sporangium.» This fact seems very extraordinary! In front view the frond resembles *C. tithophorum* Nordst. *v. major* Racib. (Desm. nov. 1889, p. 11, t. V, f. 9), but the other views essentially differ.

113. **C. octagonum,** n. sp. C. minus, fere tam longum quam latum, octagonum; semicellulæ quadraticæ, basi rotundatæ, angulis superioribus cæsis, apice et lateribus paullo incurvatæ, ventre tumidæ; membrana glabra; sinu lineari, extrorsum vix aperto. A vertice visum fusiforme; a latere angulato-lanceolatum.

Long. 15, lat. 14, lat. isth. 4—5, crass. 5—6 μ. T. X, f. 12 (and Wallich Mscr. No. 202).

Near to *C. concinnum* (Rabh.) Reinsch, Alg. Frank. p. 110, t. IX, f. III, but with sides and apices incurvate, not straight; it also differs in being centrally tumid; it differs from *C. Meneghinii* Bréb. in the vertical and lateral aspects. This species often forms filaments of 3—7 fronds.

114. **C. sparsum,** n. sp. C. submediocre, vix $1^1/_2$-plo latius quam longius, late ovale; semicellulæ dolabriformes basi deiectæ acutæ dorso depresso-rotundatæ. ventre paullo

tumidæ; membrana subtiliter et dense punctata; sinu acuto triangulari, externe constricto fere occluso. A vertice visum ovali-ellipticum apicibus attenuatum sub-dentatum. Zygospora globosa, processubus brevibus capitatis munita.

Long. 25, lat. 32, lat. isth. 10, crass. 11—14, diam. zyg. c. acul. 46, s. acul. 33 μ (sec. WALLICH Mscr. Nos. 169 et 176). T. XIX, f. 13, 16×700.

Apparently nearest to Nos. 16 and 69 of this memoir; it is a member of the series containing *C. obsoletum*, HANTZSCH; *C. ellipticum*, DELP., etc.

115. **C. prominens**, n. sp. C. minutum, quarta parte longius quam latius; semicellulæ ovales, granulum vel tuberculum unicum in ventre habentes; membrana glabra; sinu triangulari, acuto, externe valde ampliato. A vertice visum ovale; a latere modice constrictum, incisura mediana sub-acuta, semicellulæ globosæ.

Long. 15, lat. 12, lat. isth. 4—5, crass. 9 μ (also WALLICH Mscr. No. 154).

T. X, f. 7.

The front and lateral views are much like *C. bioculatum* BREB. *var. omphalum* SCHAAR. (Des. Hung. p. 270, t. I, f. 9), but the vertical aspect differs in being broadly oval.

116. **C. umbonatum**, n. sp. C. minutum, circ. $1^1/_3$ longius quam latius, octagonum; semicellulæ sub-quadratæ, basi rotundatæ, angulis superioribus cæsis; angulis lateribus apicibusque incavato-sinuatis; semicellulæ in centro paullo tumescentes, tuberculo unico instructæ; membrana glabra; sinu profundo, lineari. A vertice visum ellipticum; a latere modice constrictæ, semicellulis sub-globosis. (Forsan *β umbonatum C. Meneghinii?*)

Long. 13, lat. 9, lat. isth. 4, crass. 7 μ (also WALLICH, Mscr. No. 156).

»These tubercles do not appear to be constant, as some specimens, having exactly the same dimensions, and with the other characters similar, are deficient in these appendages,» G. C. W.

T. X, f. 10.

117. **C. Cambricum,** COOKE and WILLS (in Grevillea, p. 91, 1880) **f. minor**

Long. 25, lat. 17, lat. isth. 7 μ. T. X, f. 15.

This species is separated from *C. venustum* BRÉB. with some doubt; the only difference being that the sides of *C. cambricum* are more regularly inclined to the apex, and the undulations are smaller than in the other species.

118. **C. venustum,** BRÉB. (Liste, p. 124, t. I, f. 3), **formæ:**

Long. 19, lat. 12, lat. isth. 4 μ. T. X, f. 20.

» 28, » 17.5, » » 4 » » » f. 24.

The latter is very near to *Didym.* (*Cosm.*) *Brauni*, REINSCH (Algenfl. p. 116, t. X, f. III c), the *truncate* forms of which are but forms of *C. venustum*. It is interesting to note that LUNDELL (Desm. Suec. p. 23) has observed a *filamentous* form of this species.

— — **forma?** Long. 21, lat. 14.5, lat. isth. 4 μ. T. XI, f. 2. This has the apices faintly retuse.

— — **forma?** Long. 25, lat. 14, lat. isth. 4.5 μ. T. X, f. 19. These two plants much resemble each other, except that the latter is longer and more attenuate; pos-

sibly they are aberrant forms of *Euastrum crassicolle* LUND. (Desm. Suec. p. 23, t. II f. 8), the apices being a little incavate.

119. **C. pusillum**, BRÉB. (*Euastrum pusillum*, BRÉB. Liste p. 125, t. I, f. 7; *Cos. pusillum*, ARCHER in Prit. Inf. p. 731), var. **retusum**; apicibus incurvatis.

Long. 13, lat. 11, lat. isth. 4 μ. T. X, f. 25.

This little form differs somewhat from BRÉB.'s figure, in being a little longer than broad.

— — **forma?** Long. 12, lat. 13.5, lat. isth, 5 μ. T. X, f. 26.

120. **C. granatum**, BRÉB. (in RALFS' Br. Desm. p. 96, t. XXXII, f. 6).

Long. 21, lat. 17, lat. isth. 5 μ
» 24, » 19, » » 6 »
» 20, » 16, » » 4.5 »
» 26, » 20.5, » » 6.7 »

Frond smooth, basal angles a little more rounded than in RALFS' figure.

— — **forma.** NORDST. (Desm. Grön. p. 7, t. VII, f. 1?).

Long. 31, lat. 20, lat. isth. 6 μ. T. X, f. 27.

The forms of this species appear to be common in Bengal; I have it also ex *Utricularia stellari*, from Malabar, comm. G. v. L.

121. **C. abruptum**, LUND. (Desm. Suec. p. 43, t. II, f. 22) β **Gostyniense** RACIB. (Desm. Polon. p. 24, t. II, f. 13), sed membrana achroa.

Long. et lat. 13, lat. isth. 4 μ. T. XI, f. 8.

122. **C.? sp.** C. parvum; semicellulæ, a basi visæ, indistincte octagonæ; apicibus late triangularibus, medio protruso; super quumque angulum tuberculo minuto instructæ. Zygospora globosa, processubus parum longis, apice bifidis, apud marginem 12—13 visis, armata. A fronte a G. C. W. non observatum. Euastri sp.?

Bas. cell. lat. 20, lat. isth. 7, crass. 13, diam. zyg. c. proc. 35, s. proc. 25 μ. T. XX, f. 8 (fide G. C. W. Mscr. No. 194).

123. **C.? sp.** C.? zygosporam egregiam habens. Zygospora rotundato-triangularis; a fine visa fere orbicularis; processubus brevibus tenuibus minute sub-capitatis armata, circ. 15 apud marginem positis. Semicellulæ longe ellipticæ, glabræ, medio tumidæ.

Bas. cell., lat. 20.5, crass. 12; zyg. long. c. proc. 30, s. proc. 19; long. proc. 5.5 μ? T. X, f. 62 (fide G. C. W. Mscr. No. 153 B) × circ. 600.

124. **C. Meneghinii**, BRÉB. (in RALFS' Br. Desm. p. 96) **f. tricrenata** (*Euastrum crenulatum* NÄG. Einz. Alg, p. 120, t, VII A, f. 7 c).

Long. 18, lat. 13, lat. isth. 4 μ. T. VIII, f. 25.

Bengal; also from the same district, ex *Utricularia flexuosa*, comm. G. v. L.; this is of larger size l. 26—29, lat. 18—20 μ.

— — **f. typica** (RALFS l. c. t. XV, f. 6).

Long. 26, lat. 20, lat. isth. 5 μ.

Bengal, G. C. W.

125. **C. puteale**, n. sp. C. parvum, vix $1^{1}/_{2}$--plo longius quam latum, ovale; semicellulæ longe ovatæ vel semicirculares, apice truncatæ, angulis basalibus sub-acute et superioribus late rotundatis; marginem versus aculeis parvis (circ. 15) et apice (circ. 6) instructæ, margine laterale seriem duplicem aculeorum parvorum (5 binatim vel

geminatim) habentes; reliqua membrana glabra; sinu lineari, angusto, parum externe ampliato. A latere visum modice constrictum; semicellulæ sub-globosæ; aculeis in ordines perpendiculares positis; apice truncatum.

Long. 35, lat. c. ac. 25, lat. isth. 9, crass. 20, long. acul. 1 μ. T. VIII, f. 31.

— — **f. munita.** Forma parva, aculeis in seriem brevem circa partem ventralem, vel interna parte basis (quaque latere 3 4) ordinatis munita.

Long. et lat. 22, lat. isth. 6 μ. T. XXII, f. 9.

But for the fact that the central part of the semicells is not protuberant, this little plant might rank as a *Xanthidium*, sub-gen. *Micracanthum*, Nob.

126. **C. Joshuæ,** Nob. (*C. botrytis v. Indicum* Josh. Burm. Desm. p. 645, t. XXIV, f. 19).

Long. 82—89, lat. 57—62 μ.

This seems to me to be larger than *C. botrytis*, and the arrangement and size of the granules totally differ.

Eastern Himalayas, ex *Utricularia stellari*, comm. G. v. L.

127. **C. Brebissonii,** Mengh. (Synops. Desm. p. 219, 1840; Ralfs Br. Desm. p. 100, t. XVI, f. 3).

Himalayas; also Roy in Dickie's Himalayan Algæ.

128. **C. sp.**

Long. 44, lat. 42 μ.

Probably a variety of *Cos. Neapolitanum* Balsamo (Alghe del Comm. di Napoli in Atti della R. Acad. fis. e mat. di Napoli, vol. I, ser. 2, p. 39, t. II, f. 14), but with the superior angles more rounded; the granules on the cytioderm are vertically arranged

Khasia, ex *Utricularia sp.*, G. v. L.

T. XXIII, f. 10.

129. **C. sp.**

Long. 35, lat. 32 μ.

This may be a variety (or even the type?) of *Cos. quadrangulatum* Hantzsch (in Rabh. Alg. No. 969; Rabh. Fl. Eur. Alg. p. 170, 1868), it closely resembles an icon kindly sent to me *in litt.* by Dr. O. Nordstedt, of which this seems a minor form.

Khasia, as preceding species.

As suggested by Rabh. l. c., Hantzsch's sp. may be a var. of *C. Broomei* Thw., which idea the tumid centre seems to confirm, but it differs from the type in being finely granulate.

130. **C. sigillatum,** n. sp. C. sub-mediocre, circ. $1^{3}/_{4}$-plo longius quam latius, oblongo-quadraticum; semicellulis sub-quadraticis, angulis superioribus rotundatis, basalibus protento-rotundatis in apice acuto terminatis; margines granulatæ, granulis ordinatim sub-verticaliter positis, sed prope isthmum utroque latere ordine singula granulorum munitæ; centrali parte semicellularum lævi, at tumore circulum granulorum ferente ornata. A latere, late lanceolatum, apicibus rotundato-truncatis.

Long. 40, lat. 24 μ. T. XXIII, f. 11.

In general outline it is near to *C. incisum* Racib. (Des. Polon. p. 14, t. X, f. 7), but the acutely prolonged basal angles and the peculiar ornamentation separate this from all known forms.

East Bengal, from *Utricularia flexuosa*, G. v. L.

131. **C. pseudogranatum,** Nordst. (Desm. Bras. p. 211, t. III, f. 27, 1869), **f. media,** Nordst.
Eastern Himalayas, from *Utricularia stellaris*, G. v. L.
Long. 42, lat. 22, lat. isth, 8.5 μ.

132. **C. pulcherrimum,** Nordst. (Desm. Bras. p. 213, t. III, f. 24), **α typica.**
Long. 41, lat. 29, lat. isth. 9 μ.

Like the Brazilian plant, this is much smaller than the Swedish form described by Lundell, Desm. Suec. p. 34, which is $1^1/_2$ times larger.

East Bengal, from *Utricularia flexuosa*, G. v. L.

133. **C. quadrum,** Lundell (l. c. p. 25, t. II, f. 11, 1871).
Long. 64, lat. 56, lat. isth. 27 μ.
East Bengal, with the preceding sp.

134. **C. phaseolus,** Bréb. (in Menegh. Synops, p. 220, 1840: Ralfs Br. Desm. p. 106, t. XXXII, f. 5).
Long. 31, lat. 28.5, lat. isth. 8 μ.
East India, ex *Utricularia fasciculata*, G. v. L.

135. **C. pyramidatum,** Bréb. (in Ralfs Br. Desm. p. 94, t. XV, f. 4 a b c, non d e f; *Pithiscus angulosus* Ktz. Phyc. Germ. p. 129; Sp. Alg. p. 162; *Cos. ovale*, ex p., Ralfs in Annals and Tr. Bot. Soc. Edin. 1844).
Long. 57, lat. 35, lat. isth. 11 μ.
Himalayas, ex *Utricularia stellari*, G. v. L.

136. **C. craspedopleurum,** n. sp. C. parvum, circ. $1^1/_2$-plo longius quam latum, ambitu sinuato-undulatum, modice constrictum, sinu sublineari extrorsum paullo ampliato; semicellulis circularibus, margine undulatis, crenis circ. 15, apud quamque undulationem costa elevata 6—7 verrucarum radiantium constituta, in media parte tumore circulari granulis circ. 10 instructo, ornatis. Sp. inter *C. sub-crenatum* Hantzsch et *C. heliosporum* Maskell.

Long. 48, lat. 32, lat. ist. 14 μ. T. XXIII, f. 14.

This little plant has the form of Hantzsch's species with the peculiar markings of the New Zealand one; it is larger than either.

East Bengal, ut supra, comm. G. v. L.

137. **C. reniforme,** (Agdh.) Arch. **β compressum** Nordst. (Alg. N. Z., p. 146, t. V, f. 5).
Long. 52, lat. 49, lat. isth. 17.5 μ.
Malabar, ex *Utricularia stellari*, G. v. L.

In a form-classification Cosmarium might be divided into 3 sections, with 7 sub-genera, thus:

Section I. Frond oval or circular, more or less, in general outline.
  Sub-gen. A. **Cyclidium** (κυκλος = circulus). Semicells hemispherical.
    Typ. sp. Cos. Ralfsii, cristatum.
  Sub-gen. B. **Nephridium** (νέφρος = ren). Semicells oval, elliptic, or reniform.
    Typ sp. C. cucumis, margaritiferum, tetrophthalmum.
  Sub-gen. C. **Pyramidium** (πυραμὶς = pyramis). Semicells pyramidal.
    Typ. sp. C. botrytis, ovale, granatum.

Section II. Frond biglobate.

Sub-gen. D. **Sphæridium** (σφαιρα = globus). Semicells nearly or quite globular.

Typ. sp. C. moniliforme, prægrande, globosum.

Section III. Frond angular, or angularly rounded.

Sub-gen. E. **Tetridium** (τετρα = quatuor). Semicells more or less quadrate.

Typ. sp. C. conspersum, Broomei.

Sub-gen. F. **Gonatidium** (γωνια = angulus). Semicells 6- or poly-angular.

Typ. sp. C. sexangulare, Meneghinii, ex p., protractum, Sinostegos.

Sub-gen. G. **Teinidium** (τείνω = produco). Angles produced at either the apex or base of the semicell.

Typ. sp. C. porrectum, pileigerum.

Of this latter subgenus two sections might be made, one to include species like *C. porrectum*, the other might embrace such plants as *C. pileigerum*, *Kanitzii*, *pseudotaxichondrum*, *obsoletum*, etc.

Gen. 16. **Euastrum**, Ehrb.

(Abh. Berl. Akad. p. 82, 1831, mut. char.; Ralfs, emend. Br. Desm. in Annals p. 187, vol. XIV, 1844; Br. Desm. p. 78, 1848, et auct.; inclus. *Eucosmium*, Näg., Einz. Alg. p. 120, 1849 = *Didymidii* sub-gen. Reinsch Alg. Frank. p. 122, 1867).

1. **E. subintegrum,** Nordst. (Desm. Bras. p. 216, t. II, f. 8), var. **Indicum.** E. in sciagraphia fere ut in specie Nordstedtii sed paullo majus, juxta isthmum tumoribus (granulatis vel punctatis?) parvis et paullo supra tumore majore instructum. Membrana punctata.

Long. 60, lat. 40, lat. isth. 10 μ. T. VII, f. 17.

2. **Eu. verrucosum,** Ehrb. (Abh. Berl. Ak. 1833; Inf. p. 162, 1838; *Cos. cornutum*, Corda, Alm. Carlsb. Obs. p. 243. t. V, f. 30, 1839; *Cosm. verrucosum*, Mengh. Synops. p. 222, 1840; *Euast. papulosum*, Kütz. Phyc. Germ. p. 135, 1845; p. 172 Sp. Alg. 1849).

α. **typicum.** Speciminibus Europæis consimile.

β. **Wallichianum,** Nob. = var. β Wallich (Beng. Desm. p. 282, t. XIV, f. 5—7). Long. 75—79, lat. 74—80, lat. isth. 23, crass. 35—38 μ. Var. lobulis valde incisis (Wallich, Mscr. No. 197). T. XI, f. 9.

γ. **simplex,** Josh. (on Desm., J. Bot. 1885, p. 34, t. 254, f. 2), **forma tumescens,** n. f. Simplex, vix lobatum, apice sub-acuto incavatum, apud angulos superiores rotundatum; margine apicem versus incurvata; superficie dense verrucosa. tumore centrali unico ornata.

Long. 80, lat. 78, lat. isth. 21 μ. T. XI, f. 9*.

Hab. β, Bengal; α and γ, Northern India.

It is noteworthy that while all other forms of *E. verrucosum* fall under the subgenus *Eucosmium* (cfr Näg. Einz. Alg. p. 120), the var. of Wallich is deeply incised at the apex — this causes some doubt as to its really being a *true* variety of *E. verrucosum*.

3. **E. turgidum,** Wallich (Desm. Beng. p. 283, t. XIV, f. 17, 18, 1860).

α. **typicum,** Wallich l. c.

Long. 120—135, lat. 80—97, lat. isth. 22—30, lat. lob. pol. 50—56, crass. 44—50 μ. WALLICH gives long. 127, lat. 97 μ. (Also W. Mscr. No. 193).

T. X, f. 28 a—d.

Grunovii, NOB. (Desm. Insel Banka p. 14, t. II, f. 22). F. lobo polari ad apicem truncato, paullulum convexo — tumore centrali unico ornata.

Long. 100—120, lat. 75—80, lat. isth. 25—32 μ. T. X, f. 29.

GRUNOW's fig. gives long. 140, lat. 106, lat. isth, 38 μ.

— — **forma bitumida.** F. tumoribus duobus centralibus ornata; tumores utrobique isthmi (paullo supra fines sinus) transversatim positi. Specimen unicum mihi visum. Icon omissa; in lineamentis ut in β.

Both these were found by me in the remnant of Dr. WALLICH's gatherings; of α I only saw 3 specimens.

4. **Eu. platycerum,** REINSCH (Contr. Alg. Fung. p. 85, t. XII, f. 6), var. **pulchrum.** Fere ut in f. typica, sed semicellulæ annulis granulorum centralibus ornatæ.

Long. 46—52, lat. 39—42. lat. isth. 6—7 μ. T. X, f. 44.

RACIBORSKI (Desm. Nov. p. 33, t. VI, f. 3) gives a form which he styles var. *Italicum* of *E. bellum* NORDST.; but the outline of fig. 3 a is much nearer to REINSCH's plant than to NORDSTEDT's, and 3 b is very different.

5. **Eu. commissurale,** BREB. (*Cosm. commissurale*, in MENGH. Synops. p. 220, 1840; in RALFS' Br. Desm. p. 105, t. XVI, f. 8, 1848; *Eu. commissurale* WALLICH, Beng. Desm. p. 284, 1860).

The dimensions of this species vary considerably according to various authors: (α **typicum,** semicellulæ convergentes):

RALFS, l. c., long. 27.5, lat. 38—41.7, lat. isth. 11.7, crass. 22.3 μ.
WALLICH, l. c., » 45.7, » 40.7, μ.

Var. γ **Wallichii,** n. v. (W. l. c. t. XIV, f. 14—16; Mscr. 191 and 209, 1855). Crassum, lobo polari fere obsoleto; semicellulis divergentibus.

Long. 26, lat. 45.7, lat. isth. 11, crass. 18 μ, W. l. c.
26, » 46, » 9, » 17 μ. T. XI, f. 10 a—c.

RACIBORSKI (Desm. Nov. p. 33) seems to suggest that this form is more closely allied to *E. breviceps*, NORDST., *E. bellum*, NORDST., and *E. platycerum*, REINSCH. A close comparison of the figures shews that WALLICH's view is probably more correct in placing this as a var. of *E.* (*Cos.*) *commissurale*, BREB.

Var. δ **capitatum,** n. v. Hexiradiatum, stellatum, lobo polari protenso paullulum capitato vel apice dilatato; semicellulæ divergentes.

Long. 39, lat. 32—40, lat. isth. 7—8, crass. 15 μ. T. XI, f. 11 a, b.

Var. β **crassum,** NORDST. (Desm. Bras. p. 213, t. III, f. 19, sub *Cosmario*) **forma?** Semicellula unica a me visa. Lat. 40, crass. 21 μ. T. XI, f. 27. (Lat. usque ad 33 μ, crass. 20 μ, NORDST. l. c.)

Although many authors regard this and the following forms as belonging to *Cosmarium*, I think that the deeply incised and radiate (or distinctly lobate) forms attach more to *Euastrum* than that genus; although these have the polar lobes plain, crenate or serrate, and not incised, yet WALLICH's remarks (p. 284 l. c.) certainly are

well-founded. I hardly think f. 27 can be NORDSTEDT's var., as, although the thickness is the same, the breadth differs.

6. **Eu. clepsydra,** WALLICH (l. c. page 284, t. XIV, f. 19—21; Mscr. No. 195).

Long. 33, lat. max. 36, lat. isth. 23 μ. W. l. c.

» » » 35—38, » 8—11, crass. 16 μ. T. IX. f. 51.

Mungulpore, 20 Oct. 1855, G. C. W.

This and the preceding species would be, by many authors, accepted as Cosmaria; but the presence of distinct lobes relegates them to this genus.

7. **Eu. nobile,** n. sp. E. minus, circ. tertia parte longius quam latum, quadraticum; semicellulæ late quadratæ, angulis superioribus curte lobatæ, paullo inflatæ; apud apices latissimæ; lateribus incisæ, bi-emarginatæ; apice truncatæ, emarginato-qvadrifidæ (emarginationes apicales bi- tri-dentatæ); latere et angulis superioribus etiam dentatæ; membrana glabra; sinu profundo, lineari, extrorsum parum ampliato. A vertice et a latere non cl. Wallichio observatum.

Long. 20—26, lat. 18—20, lat. isth. 4—5 μ (fide WALLICH Mscr. No. 206).

T. X, f. 2 × circ. 700.

It is to be regretted that Dr. WALLICH has not given further details of this beautiful species. Judging from the drawing it appears to have one amylum-corpuscle (large) in each semicell.

8. **E. cruciforme,** WALLICH (Mscr. No. 198, e. p.). E. submediocre, paullo longius quam latum, sub-radiatum; semicellulæ trilobatæ, valde incisæ; lobis lateralibus protentis, apice triangulatis 3-dentatis, apicem versus sparse dentatis; lobis polaribus apice sinuato-truncatis utroque angulo dentatis; semicellulæ in centro annulo granulorum 7—8 ornatæ; reliqua membrana lævi; isthmo contracto; sinu triangulari-cuneato, acuto, amplo. A latere visum semicellulæ basi globosæ, supra attenuatæ, apice rotundatæ.

Long. 38, lat. 36, lat. isth. 9.5 μ. T. XI, f. 13.

This and the succeding species are near to *E. sphyroides* NORDST. (Alg. N. Z. p. 32, t. 3, f. 3); this one differs in its polar lobes, and No. 9 seq. also in those lobes, from that species — in this they are truncato-sinuate and inornate, in *E. schizostaurum* they are expanded and divided into two parts by a shallow triangular notch.

9. **E. schizostaurum,** n. sp. (*E. cruciatum*, WALLICH Mscr. No. 198, e. p. 1855; non *Cos. cruciatum*, BRÉB. Liste, p. 129, t. I, f. 14). E. submediocre, paullo longius quam latum, stellato-cruciforme; semicellulis trilobulatis, apicibus lobulorum 4-angulatis, angulos et marginem dentatis; lobo polari inciso-quadratico, angulis et marginibus dentato; semicellulæ ventre modice tumidæ, annulo granulorum (granula unica inclusa) ornatæ; sinu cuneato, acuto, modice aperto. A vertice visum sub-anguste oblongum, paullo tumidum; a latere bi-globulatum superne capitato-rotundatum

Long. 38—42, lat. 33—37, lat. isth. 9, crass. 14 μ. T. XI, f. 12

Cfr remarks sub No. 8, to which I would add that these two forms much resemble in outline (a fronte) a variety? of RACIBORSKI's (in Desm. Nov. t. VI, f. 3 b, non a), attributed by him to *Eu. bellum* NORDST. (Desm. Bras. p. 218, t. II, f. 6) as *var. Italicum* ejus, but neither a or b can hardly be referred to *E. bellum;* vide note sub No. 4.

10. **E. ansatum,** FOCKE (Phys. Stud. I, p. 64, t. I, f. 8, 1847; non EHRB. Lebensd. p. 82, 1832; nec Infus. p. 162, t. XII, f. VI, 1838; *E. didelta* RALFS in Annals, p. 190 ex p., t. VII, f. 2 c—f, 1844).

»The sporangium is tuberculate», G. C. W. (Beng. Desm. p. 283).

Near Mungulpore, 21 Oct. 1855 (W. Mscr. No. 200 c. icone); ZELLER et RABH., Arracan, 1873; Khasia, comm. G. v. L., 1889.

Concerning the zygospore, the above is noted from WALLICH, l. c. p. 283. The icon, however, given in his Mscr. No. 200 ('*E. didelta?*') is *in outline* exactly like *β supraposita* NORDST. (Desm. N. Z. p. 33, t. 3, f. 4), but as it internally differs therefrom I propose to name it:

— — *γ* **supposita,** n. v. Semicellulæ lobis basalibus sinuosis, tumoribus binis supra isthmum horizontaliter ordinatis et insuper tumore unico ornatæ. Long. 78, lat. 42 *μ*.

With respect to Dr. WALLICH's remark on the zyg. being tuberculate, this conflicts with NORDSTEDT's observation (Norg. Desm. p. 9) »Zygosporæ globosæ verrucis obtuse conicis hyalinis obsessæ», probably WALLICH confused with this the zyg. of the succeeding species.

11. **E. didelta,** (TURPIN?) RALFS (= *Heterocarpella didelta?* TURP. Mém. p. 295, f. 16, 1828; *Cos. didelta,* MENGH. Synops. p. 219, 1840; *Eu. didelta,* RALFS ex. p. in Annals t. VII, f. 2 a, b, 1844; FOCKE Phys. Stud. p. 64, t. I, f. 9, 1847; *Cos. fenestratum* CORDA, Alm. t. V, f. 29, 1839).

Long. 130, lat. 65, diam. zyg. 77 *μ* (fide WALLICH Mscr. No. 190 as. *Eu. ansatum?*). W. Desm. Beng. p. 283.

T. XI, f. 7 (zygospore only, after G. C. W., Mscr. l. c.).

WALLICH's descr. in D. Beng. l. c. does not accord with the figure in Mscr. which, on after consideration I am disposed to think is novel. It may be described as *β* **Bengalicum,** LAGERH. (Desm. Beng. p. 6, t. I, f. 3) forma **simplex,** n. f. Lateralibus vix sinuosis; semicellulæ basi dilatatæ, supra incavatæ; sinu lineari brevi, subito ampliato; angulis basalibus acuto-rotundatis; tumoribus basalibus tribus ornatum.

The outline is almost like *E. ansatum,* the basal portion being dilated, and somewhat acute at the dilated extremity of the side. »The sporangium . . . is tuberculate», G. C. W. p. 283. As TURPIN's form is rather a *Cosmarium,* this species ought to rank as *Euastrum fenestratum,* CORDA.

12. **E. humerosum,** RALFS (Br. Desm. p. 82, t. XIII, f. 2, 1848).

G. C. W., Desm. Beng. p. 283.

13. **E. affine,** RALFS (in Annals N. H., vol. XIV, p, 191, t. VII, f. 3, 1844).

Dr. WALLICH is evidently of opinion that this and the preceding are closely related, as he says (p. 283 l. c.) »the transverse views of these two forms merge one into the other»; to which I would add that the *lateral* views do not agree in form, and consequently separate them.

14. **E. gemmatum,** BREB. (*Cosm. gemmatum,* BRÉB. in MENGH. Synops. p. 221, 1840; *Eu. gemmatum,* KTZ. Phyc. Germ. p. 134, 1845; *Eucosmium Hassalianum,* NÄG. Einz. Alg. p. 121, t. VII B, 1849).

This species seems widely distributed

Bengal; Northern India, J. S.

15. **E. crassum,** BRÉB. (*Cosm. crassum*, BRÉB. in MENGH. Synops. p. 222, 1840; *Eu. pelta*, RALFS Annals p. 190, t. VII, f. 1, 1844, non *Cos. pelta*, CORDA; *Eu. crassum*, KTZ. Phyc. Germ. p. 135, 1845).

WALLICH, l. c. p. 283.

Note. The var. β of RALFS Br. Desm. p. 81, t. XI, f. 3 e, as suggested by LUNDELL (Desm. Suec. p. 19) is probably the same as *E. ventricosum*, LUND., l. c. t. II, f. 2.

16. **E. ampullaceum,** RALFS (Br. Desm. p. 83, t. XIII, f. 4) var. **incavatum.** Semicellulæ parte centrali vix tumidæ, tumoribus 4 (2 basalibus, 2 apicalibus) ornatæ; membrana punctata.

Long. 66, lat. 38, lat. isth. 10 μ. T. X, f. 59.

This differs considerably from the type in having the ventral portion of the semicells without swellings.

Northern India; also ZELLER and RABH. 1873, from Arracan.

17. **E. ventricosum,** LUND. (Desm. Suec. p. 18, t. II, f. 2) var. **Floridanum** (*Eu. Floridanum*, TURNER Desm. p. 935, t. XV, f. 7). E. centrali parte sub-planum non vel paullo tumidum; lobo polari exserto. Fere ut in specim. Americanis.

Long. 94, lat. 55, lat. isth. 15 μ. T. XI, f. 19.

Central India; one (semicell.) only seen.

18. **E. obesum,** JOSHUA (Burm. Desm. p. 638, t. XXIII, f. 19, 20) f. **glabra.** Membrana glabra, non granulata.

Long. 58—65, lat. 37—44, lat. isth. 16—17 μ. T. X, f. 61.

I at first (1883) described this in litt. as *E. latum*, mihi, but afterwards deemed it to be a punctate form of *E. pingue* ELFV. (Finsk. Desm. p. 7, t. I, f. 3, Oct. 1881; = *E. Armstrongianum* ARCHER (sp. ined.) in Dubl. Club Proc. July 1881; Annals N. H. vol. XI, 1883, pp. 213—14); as *some* of the specimens resemble it in outline; still as I have seen none granulate, (which nearly all the specimens of *E. pingue* are,) I place it under the species published by JOSHUA. For the fact that ELFVING's species is the same as ARCHER's I am indebted to Mr. J. ROY, 4 Apl. 1885. The form figured is the smooth, not punctate or granulate, one.

19. **E. erosum,** LUND. (Desm. Suec. p. 22, t. II, f. 6), formæ:

b. f. **attenuata.** Semicellulæ e basi regulariter attenuatæ.

Long. 29, lat. 15, lat. isth. 6 μ. T. X, f. 21.
» 27, » 17, » » 7 μ. » » f. 18.

c. f. **undata.** Semicellulæ attenuatæ, lateribus valde undatæ.

Long. 26, lat. 15, lat. isth. 5 μ. T. X, f. 23.

b. Bengal; c. Northern India.

The forms are all, apparently, smooth. It may be that c is referable rather to *E. crassicolle* LUND. l. c. (p. 23, t. II, f. 8) than to this species.

Note. The *Eu. sublobatum* (REINSCH) non BREB., *forma;* REINSCH Contrib. p. 92, t. XIII, f. 4 (44.8×25 μ) seems to be but a large specimen of the Swedish form of *E. erosum*.

20. E.? sp. E.? *E. erosum*, Lund. ut supra, et *Cosm. crenatum*, Ralfs (Br. Desm. p. 96, t. XV, f. 7) intermedium!

Crenas speciei posterioris et apices sp. prioris habet.

Long. 22, lat. 14, lat. isth. 5 μ. T. X, f. 22.

Possibly also related to the forms given by Reinsch as *C. Meneghinii, formæ* (Contr. p. 88, t. XII, f. 12 a, b), non c, which is *C. Meneghinii*, while the others are not.

21. E. singulare, n. sp. E. minus; circ. 4-ta parte longius quam latum; indistincte hexagonum; semicellulæ sub-pyramidatæ; basi valde inflatæ, supra attenuatæ; lateribus 3—4 crenato-undatis, crena basali protrudens, apicem versus incavatis; apicibus rotundatis, incisura apicali rotundata; sinu lineari, angusto, externe ampliato; membrana glabra. Cum præcedente valde congruens.

Long. 26, lat. 21, lat. isth. 4 μ. T. X, f. 45.

This peculiar form, like No. 20, seems to combine the characters of two genera. The *rotund* little protrusions upon the rounded basal angles are very distinctive.

22. E. orientale, Nob. (*E. insigne*, Wolle Desm. U. S. A., p. 102, 1884, t. XXVII, f. 39—43?, non Hassall Br. Fr. Alg. (sine descriptione; in contextu et Indice omissum!) vol. II, p. 21 (nomen solum!), t. XCI, f. 2, 1845; = *Eu. gracile*, Rlfs. Bot. Soc. Edin., et exsicc., 1844).

E. mediocre, $1^{1}/_{2}$-plo longius quam latum, trilobatum; lobus polaris valde protentus; apicibus cuneate incisis; angulis omnibus rotundatis: semicellulæ lageniformes, basi late dilatatæ, in basali parte tumoribus duobus ornatæ; sinu acuto, sub-cuneato. extrorsum valde aperto; membrana dense punctata. A latere visum truncato-lanceolatum, acute constrictum, ad tumores basales et angulos apicales acuto-rotundatum,

Long. 64, lat. 42, lat. isth. 12, crass. 28 μ. T. X, f. 34; XI, f. 26.

Wolle's form is very near this, but hardly exactly the same; there is a little difference in the basal or vertical view, the tumid parts being (in that view) more angular than in this plant. Mr. Wolle's form is certainly not *E. insigne* of Hassall, but his *E. mammillosum* decidedly is so, but with the basal protuberances dejected and lengthened: the latter might stand as var. *β mammillosum*, Wolle, a form I have seen from Fiskeland in Norway, also termed *E. insigne c montanum* by Racib. in Desm. Polon. p. 36, t. IV, f. 1, 1885. *E. orientale* is apparently between *E. insigne*, Hassall, l. c., and *E. intermedium*, Cleve (Bidr. p. 484, t. IV, f. 1); from the latter it differs in the tumours at base, and hence in the lateral view, which is more like the side view of *E. intermedium* of Wolle l. c., t. XXIX, f. 1—5 (= *E. Wollei*, Lagerh. Bidr. Amer. p. 233), not Cleve's species. However, it is difficult to reconcile the words of Cleve »ecphymatibus nullis», with the remarks of Lundell, Desm. Suec. p. 21 (t. II, f. 4), and it seems probable that the distinguished author of the species must have been mistaken.

[*Note.* Respecting the allied species *E. insigne*, I think that Ralfs' name of *E. gracile* has priority, as not only was Ralfs' public description and distribution prior to Hassall's work, but Ralfs (Br. Desm. p. 84) says that Dr. H. actually published from his specimens distributed »under the name» of *E. gracile!* This seems to be only a portion of the appropriation so far as the *Desmidieæ* are concerned, for, except the

Closteria (evidently copied from EHRENBERG's 'Infusionsthierchen'), nearly all the remaining Desmids are figured (without acknowledgement) from the plates by RALFS in Annals N. H., and Trans. Bot. Soc. Edin.; even RALFS' errors are reproduced!]

23. E. sinuosum, LENORMAND (in Herb. 1845, sec. RALFS Br. Desm. p. 85; *E. circulare*, HASS. Br. Fr. Alg. p. 383, t. XC, f. 5, 1845, figura vitiosa!).

Long. 68, lat. 41, lat. isth. 14 μ.

This, as LUNDELL aptly observes, includes the *E. circulare* of HASSALL, whose figure is only *E. sinuosum* very badly drawn! and which could be nothing else (if it *did* exist) than a form of *E. ansatum*, FOCKE.

Northern India.

24. E. cymatium, n. sp. E. minus, fere duplo longius quam latum, truncato-ellipticum; semicellulæ truncato-pyramidatæ, lateribus sub-profunde 3—4 undulatæ; angulis basalibus rotundatis, apicalibus paullo dilatis, conico-rostratis; apicibus truncatis, cuneate incisis; sinu lineari, angusto, extrorsum parum ampliato; membrana glabra. Inter *E. rostratum*, RALFS et *E. inerme*, LUNDELL.

Long. 42, lat. 23, lat. isth. 8 μ. T. X, f. 49.

I have only seen one specimen of this plant, on a micro-slide mounted by Dr. WALLICH, from Bengal collection. I believe it is the *E. rostratum var. β* of WALLICH, Beng. Desm. p. 283.

25. E. levatum, n. sp. E. parvum, circ. $1^1/_2$-plo longius quam latum, sub-ellipticum; semicellulæ cuneatæ, angulis totis rotundatæ, lateribus leniter sinuatæ; apicibus fissis, incisura acuta; angulis basalibus apud sinum unusquisque dente minuto dejecto munitum; sinu angusto, sub-lineari, parum aperto; membrana lævi.

Long. 31, lat. 21, lat. isth. 6 μ. T. X, f. 48.

E. inermi, LUND. (Desm. Suec. p. 20, t. II, f. 3; = *E. elegans β inerme*, RALFS, Br. Desm. p. 89, t. XIV, f. 7 e) proximum.

26. E. annulatum, n. sp. E. minus, circ. duplo longius quam latum, sub-quadratum; vix lobatum, fere simplex; apicibus protento-rotundatis, centro late fissis, utroque fine cornutis; lateribus e basi rotundatis, supra incurvatis; sinu acuto, externe ampliato; membrana glabra, sed centro semicellularum annulo granulorum ornata. A latere visum parum constrictum; semicellulæ basi ovatæ, supra attenuato-incurvatæ, apice truncatæ.

Long. 36, lat. 19, lat. isth. 8, crass. 13 μ. T. X, f. 36, 52.

Also WALLICH Mscr. No. 199.

Nearest to *E. elegans*, BRÉB. (Cos. elegans, BRÉB. in MENGH. Synops. p. 222 1840; E. elegans, KTZ. Phyc. Germ. p. 135, 1845) smaller forms with rounded basal lobes; and *E. binale*, *forma b.*, LUND. (Desm. Suec. p. 23), vide No. 28 infra.

27. E. dentiferum, n. sp. E. minus, circ. tertia parte longius quam latum, quadraticum; semicellulæ quadratæ, angulis superioribus quaque latere bidentatæ, infra contractæ; angulis basalibus rotundatæ, incisæ; apud incisuram basalem utroque latere dente acuto præditæ; apicibus truncatis, triangulariter incisis; membrana glabra, sed tumoribus 6 lateralibus prædita, et centro tumore cum annulo parvo granulorum ornata; sinu lineari, angustissimo.

Long. 21, lat. 16, lat. isth. 5 μ. T. X, f. 38.

28. **E. binale,** (Turp.) Ralfs. (Annals N. H. vol. XIV, p. 193, t. VII, f. 7; *Heterocarpella binalis*, Turp. Dict. Sci. Nat. f. 14, 1820 sec. Ralfs; *Cosm. binale* Menegh. Synops. p. 221, 1840). Formæ:

a. **minuta,** Nob. Lundell, l. c. p. 22; Ralfs, f. 8 e.
Long. 19, lat. 14.5, lat. isth. 5 μ. T. X, f. 50.

b. **ventricosa,** Nob. Lundell, l. c. p. 23; Ralfs Br. Desm. t. XIV, f. 8 b.
Long. 24, lat. 18, lat. isth. 6, crass. 12.5 μ.

c. **subsecta,** Nob. Lobis basalibus divisis; apicibus inermibus.
Long. 20, lat. 16, lat. isth. 5 μ. T. X, f. 30.

d. **secta,** Nob. Lobis basalibus sinuato-bilobulatis; Lund. (Desm. Suec. p. 23; Ralfs Br. Desm. t. XIV, f. 8 c).
Long. 23.5, lat. 16, lat. isth. 5, crass. 11 μ. T. X, f. 35, 39.
» 20, » 16, » » 4 μ. » » f. 47.
» 24, » 17, » » 6 μ. » XI, f. 5.

This form is probably the same as *E. elegans var. Danica*, Jacobs. Desm. Danmk. p. 191, t. VII, f. 14.

With reference to this species I would observe that many of the *smaller* forms usually attributed to *E. elegans*, Bréb., really belong to *E. binale*. The following *may* belong to this species:

Var. **unicorne,** n. v. E. minus; semicellulæ basi rotundatæ, supra sinuatæ, attenuatæ; apicibus truncato-retusis, ad angulos utroque latere mucrone parvo munitis; semicellulæ centro tumidæ annulo granulorum ornatæ. A latere visum ovato-lanceolatum, attenuatum, apice rotundatum; modice constrictum.

Long. 24, lat. 15, lat. isth. 4.5 μ. T. X, f. 58 (also in Wallich Mscr. No. 201).

Hab. d. Northern India; a, b, c, and var. Bengal; c. also from East Bengal, ex Utricularia flexuosa, comm. G. von L.

29. **E. simplicius,** n. sp. E. minus, circ. quinta parte longius quam latius; semicellulæ indistincte hexagonæ, lateribus sinuato-alatæ plusquam lobatæ; angulis basalibus rotundatis sub-acute protentis, apicalibus plus minus mucronatis sæpe inermibus vel rectis; semicellulæ lateribus in superiore parte incavatis, apicibus cuneate fissis; utraque semicellula tumoribus apicalibus 2 parvis et basalibus 2 majoribus ornata; membrana reliqua lævi; sinu acuto, anguste cuneato. *E. binali* (Turp.) Ralfs proximum.

Long. 30, lat. 24, lat. isth. 9.5 μ. T. X, f. 31.

— — f. minor. Long. 22, lat. 18, lat. isth. 5 μ. T. X, f. 41.

30. **E. quintanum,** n. sp. E. sub-mediocre, quarta parte longius quam latum; semicellulæ pyramidato-truncatæ (apicibus triangulariter fissis, leviter rotundatis, crenatis, angulis rostratis), apicem versus contractæ; lateribus tripliciter emarginatis, dentatis basali parte ad fines rotundata etiam dente unico armata; membrana glabra, sed tumoribus 5 (4 angularibus 1 centrali) ornata; sinu lineari, angustissimo, vix ampliato.

Long. 42, lat. 33, lat. isth. 7 μ. T. X, f. 42.

This is near to, but smaller than, *E. pictum* Börgesen (Desm. Bras. p. 939, t. II, f. 19), in the lateral outlines it somewhat resembles it, but that form has 7 inflations, this only 5.

31. **E. substellatum,** Nordst. (Alg. et Char. p. 7, t. I, f. 12, 1880) **forma Bengalensis.** Angustior (a fronte) et crassior quam f. typica.

Long. 52, lat. 46, lat. isth. 12.5, lat. lob. pol. 18, crass. 22 μ. T. X, f. 32.

This seems to be an oriental species, the original being found in *Utricularia flexuosa* (herb. Blume) from Java.

F. typica, from *Utricularia sp.*, from Khasia, comm. G. v. L.

Long. et lat. 48 μ.

32. **E. micracanthum,** n. sp. E. sub-mediocre, circ. tertia parte longius quam latum; truncato-ovale; semicellulæ truncato-pyramidatæ, e basi attenuatæ, apice truncato-rotundatæ; tumoribus 8 (4 lateralibus, 2 apicalibus et 2 lobum polarem versus) ornatæ; lateribus basi acute rotundatis, tridentatis, supra emarginatione bidentata, obsessis; apicibus paullo protentis, incisis, angulis recurvatis bidentatis (fere ut rostello avis aperto; membrana reliqua glabra; sinu lineari, extrorsum parum aperto. Semicellulæ cum vel sine inflatione centrali. A latere modice constrictum; semicellulæ basi tumidæ, supra sub-rectæ, apice truncatæ.

Long. 45, lat. 32, lat. isth. 9 μ. T. X, f. 33.

Probably nearest to *E. Nordstedtianum*, Wolle; cfr No. 48 seq.; from which it differs in the emargination of the sides and in the base of polar lobes being almost unconstricted.

33. **E. acanthopleurum,** n. sp. E. parvum, quinta parte longius quam latum, quadraticum; semicellulæ quadratæ, basi inflatæ, rotundatæ, apicem versus paullo contractæ; angulis totis bidentiferis, dentibus brevibus, apicibus truncatis, cuneate incisis; quaque semicellula tumoribus parvis (1 centrali (sæpe carente), et 4 marginalibus) ornata; reliqua membrana glabra; sinu lineari, externe parum aperto.

Long. 20, lat. 16, lat. isth. 5 μ. T X, f. 46.

Near to *Eu. denticulatum* (Kirch.) Gay; *Eu. binale β denticulatum* Kirch.; Gay, Not. p. 335, = *E. amœnum*, Gay (Conj. p. 53, t. I, f. 7), but differs both in the lateral outline and the ornamental tumours.

34. **E. Candianum,** Delp. (Desm. Sub-alp. p. 95, t. VI. f. 11—12) **var. munitum,** n. v. E. parvum, margine spiculiferum; utroque apice 6, utraque latere (super lobum basalem) 3, spiculis parvis munitum. Minus, tertia parte, quam species Italica.

Long. 20, lat. 7.5, lat. isth. 5 μ. T. X, f. 40.

35. **E. acanthophorum,** n. sp. E. parvum, circ. quinta parte longius quam latum; semicellulæ truncato-pyramidatæ, basi et apice inflatæ; lobis basalibus rotundatis tri-dentatis; apicibus paullo protentis rotundatis, cuneate fissis, angulis quoque latere expanso-bidentatis, et marginem apicalem versus spinula brevi erecta munitis; membrana glabra?; sinu profundo, lineari, extrorsum aperto. A vertice et a latere non observatum.

Long. 34, lat. 27, lat. isth. 8 μ. T. X, f. 53.

Species inter *E. binale* (Turp.) Ralfs, et *E. cuspidatum* Wolle (Desm. U. S. p. 105, t. XXVII, f. 32).

36. **E. declive,** Roy (in Flora of Leicestershire, Bates' List of Algæ, p. 35 (separ.), 1886; *Euastrum elegans* Bréb. *forma declivis* Reinsch Gen. Alg. Fung. p. 124, t. XX d, f. 1—3, 1866).

Long. 26, lat. 19.5 μ.

This comes very near to several forms related to *Eu. elegans*, but is unlike them all. The Indian form had a small annulus of granules in the centre of the semicells, and might stand as **var. β ornatum.**

37. **E. projectum,** n. sp. E. parvum, quinta parte longius quam latum, quadraticum; semicellulæ sub-quadratæ, paullo attenuatæ, basi rotundatæ, latere 2-sinuatæ, apice cuneate fissæ recte truncatæ; apicibus quoque latere paullo dilatatis mucronatis; semicellulæ tumoribus tribus (1 centrali 2 marginibus) basalibus ornatæ; reliqua membrana lævi; sinu lineari. angustissimo, extrorsum vix aperto. A latere visum modice constrictum; semicellulæ lanceolatæ, apicibus acuto-rotundatæ

Long. 20, lat. isth. 6, crass. 10 μ. T. X, f. 56.

WALLICH Mscr. No. 199, ex p.

Eu. binàli proximum.

38. **E. præpandum,** n. sp. E. minus, quinta parte longius quam latum; habitu generali *E. binali* accedens; in parte superiore laterum prominentia acuta unica, et apicibus truncatis fissura semicellulari, præditum.

Long. 17.5, lat. 15, lat. isth. 6 μ. T. X, f. 57.

(After WALLICH Mscr. No. 205).

39. **E. radiatum,** n. sp. E. submediocre, circ. $1^3/_4$-plo longius quam latum; longe ovale; semicellulis semi-ovatis, lateribus bi- tri-incisis, in 5—6 lobulis sectis, emarginatis vel minute ad angulos dentatis; lobo polari exserto, inciso, apice rotundato, quoque latere recurvo; angulis apicalibus uni- vel bi-apiculatis, semicellulæ tumoribus parvis (2 marginales, 2 apicales, et 2 paullo supra centralem partem horizontalibus positis) ornatæ; sinu lineari, profundo, angusto, extrorsum vix aperto; membrana?

Long. 52, lat. 30, lat. isth. 7 μ. T. X, f. 54.
» 48, » 27, » » 8 μ. » » f. 55.

E. serrato JOSH. (Burm. Desm. p. 639, t. 23, f. 1, 2) propius, sed differt lobulis sectis et angulis superioribus apiculatis.

40. **E. incurvatum,** n. sp. E. minus, habitu a fronte *E. annulato* (No. 22 supra) consimile. A latere visum modice constrictum, lanceolatum; apicibus sub-acutis, et apices versus quoque latere emarginatis. Zygospora globosa, aculeis rectis, basi conicis (apud marginem circ. 14) armata.

Long. 27, lat. 15, lat. isth. 8, crass. 10, Zygosp. c. sp. 36, s. sp. 23 μ.

T. XI, f. 1 (fide WALLICH Mscr. Nos. 192 et 207).

41. **E. paradoxum,** n. sp. E. minus, quadrangulatum, quarta parte longius quam latum; semicellulæ quadratæ, lateribus tri-crenulatæ, apice truncatæ (incisura apicali semicirculari); angulis superioribus mucronatis; membrana lævi, tumore centrali prædita annulo granulorum circ. 10 ornata; sinu lineari, angusto, vix aperto. A latere visum modice constrictum, ovato-lanceolatum; apicibus acute-rotundatis; apicem versus emarginatum.

Long. 21, lat. 15, lat. isth. 5, crass. 9 μ. T. XI, f. 4.

After WALLICH Mscr. No. 205.

42. **E. rostratum,** Ralfs (Br. Desm. p. 88, t. XIV, f. 6).

Fide Wallich, Beng. Desm. p. 283.

I have not seen any form of this species, but the typical form is unmistakeable, and Wallich no doubt observed it.

43. **E. subspinosum,** n. sp. E. minus, habitu fere *E. spinoso* (No. 44) consimile, sed apicibus protentius (plus minus latis) et spinula unica, plus minus recurvata, sola munitum; membrana glabra, plana vel tumida (inornata?). Hæ duæ formæ inveni:

a. **typica.** Long. 36, lat. 19, lat. isth. 6.5 μ. T. X, f. 17.

b. **tumida.** » 32, » 19, » » 6 μ. Quaque semicellula spinulas versus duobus tumoribus lateralibus prædita. T. X, f. 37.

Nearest to the form described by Ralfs as *E. spinosum* in Annals, p. 192, t. VII, f. 6 c superior, 1844, but with rotund, not sinuate, sides.

44. **E. spinosum,** Ralfs (*E. elegans γ spinosum* Ralfs, Br. Desm. p. 89, t. XIV, f. 7 f, i, k; *E. spinosum* Ralfs, ut supra, sub 39, f. 6 a, et c inferior).

a. lateribus 2-spinatis. Wallich Mscr. 192 et 208.

b. » 3- » » » » »

Long. 25—34, lat. 17—21, lat. isth. 7—8.5 μ.

45. **E. elegans,** Bréb. (*Cos. elegans* Bréb. in Mengh. Synops. p. 222; non *E. spinosum* Ralfs, Annals, p. 193, t. VII, f. 6; *E. elegans* Ktz. Phyc. Germ. p. 135; Ralfs Br. Desm. p. 89 ex-p. (excl. var. *β* et *γ*) t. XIV, f. 7 a, b, c).

Var. **nudum,** n. v. F. semicellulis in centrali parte inornatis.

Long. 46, lat. 32, lat. isth. 12 μ. T. XI, f. 14.

Var. **planum,** n. v. Var. semicellulis a fronte nudis, tumoribus nullis præditis.

Long. 53, lat. 37, lat. isth. 10 μ. T. XI, f. 16.

In outline these two varieties resemble Ralfs' fig. 7 a, loc. cit.

Hab. The former is from Bengal, the latter Northern India.

These varieties approach *E. elegans β Cebennense* Gay Monogr. p. 53, t. I, f. 6, but besides being larger they differ in the lateral lobules from that variety.

46. **E. divaricatum,** Lund. (Desm. Suec. p. 21, t. II, f. 5). Typical form: Long. 44, lat. 37, lat. isth. 10 μ. T. XI, f. 22.

Var. **inevolutum,** n. v. F. lobulis basalibus non spiniferis; semicellulæ centro et margine granulis et tumoribus inornatæ, sed apicem versus tumoribus duobus parvis præditæ.

Long. 42, lat. 29, lat. isth. 8 μ. T. XI, f. 25.

The above, 42, 43, 44 and 46, I believe are among the forms attributed by Dr. Wallich to *E. rostratum* (Desm. Beng. p. 283).

47. **E. longifrons,** n. sp. E. submediocre, circ. duplo longius quam latum, elongatum; semicellulæ longe quadraticæ, basi rotundatæ, supra attenuatæ; lateribus 3-undulatis bi- vel tri-spiniferis; apicibus incisis, externe rotundatis angulis recurvatis aculeatis; membrana (in quaque semicellula) 7 tumoribus (4 margine, 2 apice et 1 centro) parvis, quoque annulum granulorum ferente, ornata; sinu profundo, lineari, vix externe aperto. A latere visum sub-acute constrictum; semicellulæ compresso-ellipticæ, apicem versus contractæ, apice rotundatæ utroque latere emarginatæ.

α. **major.** Long. 49, lat. 25, lat. isth. 7, crass. 17 μ. T. XI, f. 3 a.
β. **minor.** » 41, » 22, » » 7. 16 μ. » » f. » a^1, b.
E. spinoso Ralfs, ut supra, propius — sed majus et magis elongatum.

48. **E. Nordstedtianum**, Wolle (Desm. U. S. A. p. 105, t. XXVI, f. 7—13).

Var. **elegans**, n. v. Lobulis lateralibus, et angulis apicalibus ad formam typicam valde accedens; sed lobulis dentatis non aculeatis; lobo polari magno sursum constricto magis exserto, lato: apice (utroque latere incisuræ apertæ) tridentato (dentibus 2 margine et 1 sub-margine positis); semicellulæ tumoribus 9 (6 margine, 2 sub-apice, et 1 grandis centrali parte dispositis) ornatæ. Quam f. typica multo minus est.

Long. 44, lat. 36, lat. isth. 9.5 μ. T. XI, f. 17.

49. **E. clavatum**, n. sp. E. mediocre, circ. tertia parte longius quam latum, truncato-ovale; semicellulæ irregulariter truncato-pyramidatæ, basi rotundatæ aculeo unico dejecto ferentes, et supra attenuatæ cum prominentia rotundata unica aculeis binis geminatis gerens, apicem versus contractæ; lobo polari magno paullo dilatato, lineariter inciso, apice rotundato utroque latere recurvato, angulis bi-aculeato, inter aculeos incavato; membrana glabra, sed tumoribus parvis 8 (6 margine et 2 apice) prædita; sinu lineari profundo, extrorsum vix aperto.

Long. 48, lat. 36, lat. isth. 7 μ. T. XI, f. 18.

Speciei præcedenti consimile.

50. **E. prorum**, n. sp. E. mediocre, circ. 1$^3/_4$-plo longius quam latum, elongato-quadraticum; semicellulæ irregulariter quadratæ, lateribus profunde bi-undulatæ, sub-apice contractæ; lobo polari magno, paullo dilatato, valde inciso (incisura 4-angulari externe contracta), apice protento rotundato, utroque latere dejecto-recurvato, aculeo magno armato; sub aculeo apicali spinula parva habens; membrana crassa, dense punctata, tumoribus parvis 6 (4 margine et 2 apice) munita, et 1 centrale major cum granulis aggregatis ornata; sinu profundo, lineari, angusto, extrorsum vix ampliato.

Long. 56, lat. 31, lat. isth. 10 μ. T. XI, f. 23.

This appears to be closely related to *E. rostratum* Ralfs, but differs in being longer, not proportionally so broad; in the aculeate (not rostrate) apical angles, and also in being both punctate and ornate.

51. **E. quincunciale**, n. sp. E. mediocre, circ. 1$^2/_4$-plo longius quam latum, sub-truncato-ovale; semicellulæ truncato-pyramidatæ, basi dilatatæ, attenuatæ (lateribus bi-sinuatæ, utraque prominentia dentibus brevibus crassis 2 divergentibus armata), sub lobo polari vix contractæ, apicibus vix dilatatæ; lobo polari lineariter inciso, apice externe rotundato, utroque latere recurvato, angulis apicalibus bi-rostratis, inter rostra incavatis; membrana punctata, tumoribus 5 (2 basalibus, 1 major et paullo supra, et 2 apicalibus, dense granulatis) ornata, tumoribus fere in quincuncem dispositis, ex quo nomen specificum; sinu profundo lineari, angusto, extrorsum parum aperto.

Long. 54, lat. 38, lat. isth. 12 μ. T. XI, f. 21.

52. **E. stigmosum**, n. sp. E. mediocre, habitu fere *E. eleganti* consimile; membrana glabra vel subtilissime punctata, tuberculis parvis, 21 in quaque semicellula, ornata. Tubercula in serie basali 7, paullo supra in serie 6, quoque latere 1, at apice 6 (3 et 3 triangulatim ordinata) disposita.

Long. 48, lat. 32, lat. isth. 6 μ. T. XI, f. 24.

53. E. Webbianum, n. sp. E. variabile, habitu a fronte *E. ansato* Delp. (Desm. Sub-alp. t. VI, f. 31, non Focke, nec Ralfs) consimile, sed sinu lineari extrorsum valde aperto, angulis basalibus plus minus acutis; etiam paullo minus quam species referta; membrana glabra.

F. major. Long. 58, lat. 28, lat. isth. 8 μ.

Hæc forma in »Sutton Park, prope Birmingham, Angliæ», a Henrico Webb lecta est, 1852.

F. minor. Long. 26—30, lat. 13—16, lat. isth. 4 μ. T. XXII, f. 4.

Northern India.

To the memory of Henry Webb (a good and unassuming man, among 'micro-mounters' of his time *facile princeps*) I dedicate this species. I have Desmids and Algæ mounted by him, in camphor-water, still sound and perfect, although the slides were prepared 40 years ago!

54. E. inermius, (Nordst.) Nob. (*E. spinulosum* Delp. ** *inermius* Nordst. Alg. Char. p. 9, t. I, f. 17).

Long. 51, lat. 47, lat. isth. 15 μ. T. X, f. 51.

Also Wallich Mscr. No. 86.

Not uncommon in Bengal, G. C. W.; also ex *Utricularia flexuosa* from the same province, G. v. L., 1889.

55. E. carduetum, n. sp. E. mediocre, paullo longius quam latum, sub-orbiculatum, quinquelobatum; semicellulæ sub-hemisphæricæ; lobis lateralibus binis; lobo polari exserto, apice incurvato; angulis omnibus rotundatis spinulosis; lobis basalibus et polari seriebus duabus, lobis intermediis serie una, aculeorum armatis; semicellulæ juxta isthmum supra et infra verrucis elongatis tribus ornatæ.

Long. 58, lat. 52, lat. isth. 14 μ. T. X, f. 60.

This seems to be near to *E. spinulosum* Delp. (Desm. sub-alp. p. 85, t. VI, f. 17, 18), but it differs therefrom in the arrangement and number of the aculei, in the central verrucæ and in the ventral inflation and ornamentation being absent.

56. E. orbiculare, Wallich (Beng. Desm. p. 282, t. XIV, f. 8—11).

Long. 64—72, lat. 48—66, lat. isth. 20—33, crass. 24—27 μ.

Wallich l. c. Long. 71.5, lat. 64, lat. isth. 19, crass. 28 μ.

Also in G. C. W. Mscr. No. 196.

Few of the circular *Euastra* have the polar lobe so deeply incised as this species, in fact many are either incavate only or faintly retuse at the apices.

T. XI, fig. 6 a, segment with young semicell attached. b c d lateral, vertical, and basal views.

Bengal, G. C. W.; Malabar, ex *Utricularia stellari*, and from Khasia, ex *Utr. sp.*, G. von L.

57. E. nummularium, Delp. (Desm. sub-alp. p. 87, t. VI, f. 8) **var. planum,** n. v. Minus quam f. typica, sed habitu fere consimile; ventre planum, inornatum.

Long. et lat. 32, lat. isth. 11 μ. T. XI, f. 15.

Central India, J. S.

58. **E. Gangense,** n. sp.? E., ut mihi visum est, *E. ansato* FOCKE accedens, sed paullo minus, apicibus rotundatis, profunde incisis; lateribus distincte sinuatis; membrana lævi!, tumoribus 5 quincuncialiter positis prædita, tumoribus apicalibus nullis; sinu lineari, angustissimo.

Long. 52, lat. 29, lat. isth. 8 μ. T. XI, f. 20.

This decidedly resembles FOCKE's form, and also that of RALFS 2 a (non b, c), but the other differences induce me (ad interim) to separate it.

59. **E. spicatum,** n. sp. E. mediocre, circ. decima parte longius quam latum, trilobatum, stelliforme; lobi laterales horizontales, angulis acute rotundatis; sub lobo polari constrictum, lobo polari capitato-dilatato, apice incavato, angulis rotundato; semicellulæ ventre inflatæ, annulo granulorum 6—8 granulos includente ornatæ; angulis omnibus et angulos versus aculeatæ; membrana reliqua lævi; sinu introrsum lineari, extrorsum valde aperto.

Long. 60, lat. 54, lat. isth. 9.5 μ. T. X. f. 43.

E. hypochondro NORDST. propius.

60. **E. sculptum,** n. sp.? Semicellulæ fere semicirculares, incisuræ inter lobos laterales et polarem æquales; lobi quoque intermedii et polares rotundati; marginem versus et margine granulis, tumore centrali intra annulum granulis ornatum; reliqua membrana lævi; sinu lineari, sub-angusto, extrorsum ampliato. *E. spinuloso* DELP. (Desm. sub-alp. p. 85, t. VI, f. 17, 18) * *Africano* NORDST (Alg. Nonn. p. 9, t. I, f. 16) proximum, sed multo minus.

Long. 54, lat. 46, lat. isth. 17 μ. T. VIII, f. 32.

I can scarcely think that NORDSTEDT's form is a sub-sp. of DELPONTE's, it would probably rank as a species, of which this would be a minor form.

61. **E. longicolle,** NORDST. (Alg. N. Z. p. 33, t. III, f. 5) **var. Himalayense,** n. v. In sciagraphia fere ut in f. typica, sed multo minus, scrobiculis ut mihi visum est carentibus; tumoribus parvis 7 in quaque semicellula ornatum (5 basalibus quincuncem positis, et 2 minoribus ad apices); angulis basalibus paullo productis, subacutis. Membrana dense punctata.

Long. 90, lat. 39 μ. T. XXIII, f. 9.

From the Himalayas, ex *Utricularia stellari*, comm. G. v. L. Only one specimen seen.

The genus Euastrum is a natural link between Cosmarium and Micrasterias; as the genus is nothing more than an incised or lobed Cosmarium the transition between the last-named and the sub-genus Holocystis is rendered easy and natural. The following sections and sub-genera may suffice to classify by form:

Section I. **Euastrum** (sensu strict.). Lobus polaris (vel apex) incisus.
  Sub-section a. Lateral margins not, or indistinctly, lobate.
    Subgenus A. **Cosmariastrum** (*κοσμάριον*, ornamentum; *ἄστρον*, stella).
      Sinuate or incised at margins; frond circular or oval.
      Typ. sp. E. orbiculare, cœlatum.
    B. **Colpodastrum** (*κολπώδης*, sinuosus; etc.).
      Sides sinous; frond oblong, quadrate or pyramidal.
      Typ. sp. E. ansatum, giganteum, didelta, sinuosum, elegans.

Sub-section b. Lateral margins distinctly lobate.
Sub-genus C. **Amblyastrum** (*ἀμβλυς*, obtusus; etc.).
Lobes normally obsuse, not radiately arranged.
Typ. sp. E. oblongum, multilobatum.
D. **Actinastrum** (*ἀκτιν*, radius; etc.).
Lobes sub-radiate.
Typ. sp. E. Nordstedtianum, clavatum.
Section II. **Eucosmium**, Näg. (Gatt. einz. Alg. p. 120) extend.
Lobus polaris (vel apex) integer, non incisuram singulam ferens.
Sub-section a. Apex plain, crenate, or emarginate; frond lobate or sublobate.
Typ. sp. E. commissurale, clepsydra, nobile.
b. Apex not emarginate; frond distinctly lobate (Eucosmium sensu strict.).
Typ. sp. E. verrucosum, gemmatum, pectinatum; Näg. l. c.

Gen. 17. Micrasterias, Agdh.

(Ag. in Flora 1827, p. 642, fide Wittr. Skand. Desm. p. 8; Ralfs Br. Desm. p. 68; Annals N. H. vol. XIV, p. 259; Menegh. Synopsis, p. 214).

1. **M. oscitans,** Ralfs (in Jenner, Fl. Tunbr. Wells, p. 198, 1845; *Holocystis oscitans*, Hassall Br. Fr. Alg. p. 386, t. XC, f. 4, 1845), **formæ:**

α. **typica.** Ralfs Br. Desm. t. X, f. 2; Cooke in Grevillea, p. 90, t. 141, f. 2 f, 1881.

β. **intermedia,** Nob. Cooke l. c. f. 2 c, e.

γ. **mucronata** (*Tetrachastrum mucronatum*, Dixon, Dub. N. H. Rev. t. I, f. 5—8, 1859; *M. oscitans forma*, Cooke l. c. f. a, d.

α (*Tet. oscitans*, Dixon l. c. Long. 115, lat. 94 *μ*.

β. Long. 110, lat. 91 *μ*. *γ*. Long. 104—119, lat. 81 - 96 *μ*.

Sikhim; Bengal?

Concerning this species it is not a little strange that the typical form, figured and described by Ralfs, is in England and elsewhere much more uncommon than the other forms of this plant.

2. **M. laticeps,** Nordst. (Desm. Bras. p. 220, t. II, f. 14, 1869; *Micr. incisa*, Bailey, Micr. Obs. t. I, f. 13, 1850; *Tetrachastrum Americanum* Archer in P. Inf. p. 725, 1861), **forma minor,** Nordst. l. c.

Long. 118—129, lat. 138—151 *μ*, lat. lob. pol. circ. 120 *μ*.

Bengal? Central India.

I note that Nordstedt l. c. puts a query? as to Bailey's dimensions. The figure given by that author is certainly *M. laticeps*; the dimensions are probably incorrect, as my measure of Bailey's fig. only gives long. 70, lat. 91 *μ*.

3. **M. pinnatifida,** (Kütz.) Ralfs (Br. Desm. p. 77, t. X, f. 3; *Euastrum pinnatifidum*, Ktz. Phyc. Germ. p. 134: *Euastrum bifidum*. Focke Phys. Stud. p. 64, t. I, f. 12; t. II, f. 22; *Tetrachastrum pinnatifidum*, Archer, Prit. Inf. 1861), **formæ:**

α. **typica.** Long. 50—57, lat. 60—66, lat. isth. 11, lat. lob. pol. 40, crass. 14—15 *μ*. T. V, fig. 3 a, e. (Wallich Mscr. No. 87, 89, 1855; Beng. Desm. p. 275, t. XIII, f. 1, 2, 3.)

β. **quadrata,** n. f. F. lobis inferioribus apice truncatis, bidentatis. Forma loborum inferiorum ut fere *Mic. incisæ* accedens. Frons longior quam lata.

Long. 56, lat. 54, lat. isth. 10, lat. lob. pol. 44 *μ*. Fig. 3 b.

γ. **expansa,** n. f. F. lobis inferioribus expansis, medio laterum incavatis, angulis (quibusque) bidentatis; lobo polari apice rotundato, utroque fine unidentato.

Long. 56, lat. 52, lat. isth. 12, lat. lob. pol. 40 *μ*. Fig. 3 c.

δ. **inflata,** Wolle. (Torrey Bull. Suppl. 1876; Desm. U. S. A. p. 116, t. XXXVII, f. 9). F. lobis inferioribus inclinato-truncatis, angulis unidentatis; lobus polaris ut in f. typica, sed basi magis latior.

Long. 58, lat. 60, lat. isth. 12, lat. lob. pol. 42 *μ*. Fig. 3 d.

Formæ monstrosæ in figuras. 3 f et g delineatæ sunt.

Speaking of the varieties and type, G. C. W. writes in Mscr. l. c.: »Both varieties are so common at Barrackpore and at Raneegunge that I can safely assert they are distinct from *M. oscitans*, being mature and fixed forms. This is shewn in specimens in which the young segments are interposed between the old. This was written in 1855, but in 1860 Dr. W. had changed his opinion, and united the three species *oscitans*, *pinnatifida*, and *incisa* (under Hassall's genus *Holocystis*) as varieties of *H. oscitans!* I believe these species to be well-founded, as perfectly distinct. Wallich gives the dimensions as lat. et long. 50 *μ*. The *Euastrum didymacanthum* Näg. (Einz. Alg. p. 123, t. VI H, f. 1 = *Tetr. didymacanthum* Archer, in P. Inf. p. 725) is but a form of this species.

4. **M. incisa,** (Bréb.) Ralfs (Br. Desm. p. 211; *Euastrum incisum*, Bréb. in Menegh. Synops. p. 216; Kütz. Phyc. Germ. p. 134; *Eu. crux-melitensis* (*forma juvenilis!*) Ehr. Inf. t. XII, f. 3 c; *Holocystis oscitans?* Hassall, Br. Fr. Alg. t. XC, f. 3). Formæ:

α. **typica.** Long. 50, lat. 50, lat. isth. 8—9, lat. lob. pol. s. sp. 36, crass. 12 *μ*. T. VI, f. 8, 10.

β. **Wallichiana,** n. f. F. lobis basalibus truncatis, angulis inferioribus dejecto-dentatis, angulis superioribus rotundatis. (*Holocystis incisa var. β*, Wallich Desm. Beng. p. 276, t. XIII, f. 6; W. Mscr. No. 90).

Long. 48—53, lat. 45—50, lat. isth. 10—11, lat. lob. pol. s. sp. 40, crass. 11—13 *μ*. Fig. 7, 9.

γ. **aculeata,** n. f. F. lobis basalibus latere profunde incavatis, angulis protentis; unoquoque angulo aculeo convergente munito.

Long. 52, lat. 60, lat. isth. 14, lat. lob. pol. s. sp. 44 *μ*. Fig. 11.

(Wallich, l. c. f. 4; Mscr. No. 86). *Hab.* Puttah Ghât Tank, Oct. 1854; Raneegunge, Nov. 1855.

With the knowledge of subsequent research and observations before us, we can hardly, at this date, consider these forms (or, as suggested by Dr. Wallich p. 276, *Mic. quadrata* Bailey likewise) as varieties of *M. oscitans*, Ralfs.

5. **M. truncata,** (Corda) Bréb. (Ralfs Br. Desm. p. 75, t. VIII, f. 4, t. X, f. 5; *Cosmarium truncatum*, Corda Alm. Carlsb. p. 121, t. II, f. 23, 24; *E. rota* Ehr. Inf. t. XII, f. 1 g; *E. semiradiatum*. Bréb. in Menegh. Synops. (sub *E. rota junior* Menegh.) p. 215; *E. scutum*, Focke, p. 64, t. I, f. 14, etc.).

Long. 92—106, lat. 90—102 μ.

Northern India; Himalayas.

The Indian specimens approach the semiradiate form.

6. **M. expansa,** Bailey (Micr. obs. p. 37, t. I, f. 7; *M. arcuata* Bail. β *expansa* Nordst. Nonn. Alg. Bras. p. 23, fig. II xylogr.).

Forma No. 5 Nordst. l. c. accedens.

Long. 75, lat. 69, lat. isth. 11 μ.

Central India; Bengal? G. C. W.

Most observers will agree with Nordstedt's view in uniting the *M. expansa* and *arcuata* of Bailey under one specific name; Wallich also, p. 276 Beng. Desm. takes *M. arcuata* as a var. of *M. expansa.* I did not see the form or variety *arcuata.*

7. **M. tropica,** Nordst. (Desm. Bras. p. 219, t. II, f. 15; *M. expansa var. γ* Wallich, Beng. Desm. p. 277, t. XIII, f. 9; Mscr. No. 72).

Long. 92—102, lat. 85—90, lat. isth. 16, lat. apic. 40—52, lat. lob. pol. 16, crass. 28 μ. T. V, f. 1.

Wallich, l. c. gives dimensions, long. 128, lat. 115 μ, but I saw none so large as this; the Brazilian specimens of Nordstedt are long. 125, lat. 101 μ.

Raneegunge.

The margin of the central portion of the polar lobe is sometimes minutely dentate, sometimes with short strong teeth; the direction of the forks of that lobe exhibit varying degrees of divergence. The Indian form might stand as *M. tropica* β **minor.**

This form is certainly not closely related to the preceding species which is of different form, smooth and not with serrated margins; on this I cannot coincide with the views of Dr. Wallich, l. c.

8. **M. stauromorpha,** n. sp. M. parvula, paullo longior quam lata, stelliformis; semicellulæ trilobatæ, lobis lateralibus divergentibus, apice rotundatis, uterque lobus spinulam vel mucronem ferens; lobi polares longe porrecti, apice truncati, utroque angulo mucrone muniti; membrana lævis. Sinus incurvatus, magnus, extrorsum valde ampliatus. A latere visa modice constricta, acuto-lanceolata; a vertice visa fusiformis.

Long. 52—61, lat. 40—48, lat, isth. 9—10, lat. apic. 11, lat. lob. pol. 9—10, crass. 12—13 μ. T. VI, f. 16—18.

This peculiar little species is almost Euastriform in front view, it is apparently nearest to *M. arcuata* β *expansa* Nordst. (Nonn. Alg. Bras. p. 23, f. II, 6).

9. **M. rotata.** (Grev.) Ralfs (Annals N. H. vol. XIV, p. 259, t. VI, f. 1 a sinistra, et c; *Echinella rotata,* Greville in Hook. Br. Flor. v. II. p. 398, 1830; *Euastrum rota,* Ehr. Infus. t. XII, f. 1 c, e; Focke, Phys. Stud. t. I, f. 15; *Mic. denticulata,* Bréb. Alg. Fal. p. 54 ex p., t. 8; *Cosmarium stellinum,* Corda, Alm. Carlsb. p. 121, t. II, f. 22; *Eutomia rotata* Harvey Man. Br. Alg. p. 187, ex p.; etc.).

Wallich, Beng. Desm. p. 280.

Bengal, »somewhat sparingly», G. C. W. (vide Appendix).

10. **M. denticulata,** Breb. (*M. denticulata* ex p. Bréb. Alg. Fal. p. 54, et *M. heliactis* Bréb. l. c.; *Euastrum rota* Ehr. Inf. t. XII, f. 1 a; Focke, l. c. t. II, f. 1—7; *M. rotata* Ralfs Annals l. c. t. VI, f. 1 a dextra; *Eutomia rotata,* Harvey l. c. ex p.; etc.)

WALLICH. Beng. Desm. p. 280.

Bengal, »somewhat sparingly».

In WALLICH's memoir the author maintained that this and the preceeding species were but varieties of one and the same plant; against this view Mr. W. ARCHER, in two papers (N H. Soc. Dubl. 5 Apl. 1861, and 5 May 1865) contended for their separation. However the discovery by LUNDELL (Desm. Suec. p. 12, t. I, f. 2, 1871) that *Mic. rotata* had a dissimilar zygospore from that of *M. denticulata* (RALFS, Br. Desm. t. VII, f. 1 g, 1848), set this vexed question finally at rest. This result only shows how apparently closely related forms may widely differ in the form of the Zygospore.

Note For many years grave doubts existed as to whether the distinguished botanist C. A. AGARDH was truly the author of the genus *Micrasterias* (in its modern sense, as the only species described was named by him *M. furcata*, its diagnosis being very brief, »Micrasterias furcata, radiis pluries furcatis obtusis»). BRAUN, Alg. Unicell. pp. 65 and 107, refers to this uncertainty, and gives a letter from Dr. J. G. AGARDH (1855) to show that the species and genus of 1827 were valid; that the genus was undoubtedly that accepted by RALFS, but that the species was = *M. rotata* (GREV.) RALFS. BRAUN says, »Probatur igitur *Micrasteriam* AGARDHI cum *Micrasteriæ* genere sensu Ralfsiano convenire et *Micrasteriam furcatam* AG. cum *M. rotato* RALFS identicam esse,» l. c. p. 108. In the Desm. Bornholm of Dr. NORDSTEDT (appendix or abbreviation in French, p. 211) this remark of J. G. AGARDH to BRAUN is referred to. Every one knows that Dr. AGARDH, like his illustrious father, was an admirable algologist, but in the case of this plant I imagine that the determination was possibly incorrect. Dr. NORDSTEDT (a veritable Desmid-specialist!) gave me several years ago, a figure from C. A. AGARDH's original material, thus, »*Micrasterias furcata* AGDH., secundum specimina originalia in herb. J. G. AGARDHII, ab O. NORDSTEDT delineata», I found the figure was *not* that of *M. rotata*, but of *M. denticulata!* However, in justice to Dr. J. G. AGARDH, I must state that it is possible that he in 1855 (like WALLICH in 1860, and RABENHORST in 1868), considered that *M. rotata* and *denticulata* were but two forms of the same species, and this may be the true explanation of his letter to BRAUN.

11. **M. lux,** JOSHUA (Burm. Desm. p. 636, t. 22, f. 12, 1885; *M. extendens* TURNER in litt. 1884; *M. radiosa var.?* WALLICH Mscr. No. 82, 1855).

Long. 180—190, lat. 170—205, lat. isth. 18—22, lat. apic. 44, lat. lob. pol. 18, crass. 25—29 μ T. VI, f. 6.

β **Wallichii,** n. v. A fronte visa differt forma typica sectionibus lobulorum lateralium undulatis, ut in *M. radiosa*, non rectis et regulariter radiantibus; apicibus lobulorum forcipatis.

Long. 180, lat. 160, lat. isth. 20, lat. apic. 43, lat. lob. pol. 20 μ. T. XXII, f. 2.

Hab. α et β Bengal, G. C. W.; β Khasia, G. VON L.

12. **M. radians,** n. sp. M. sub-circularis, stelliformis, mediocris, subquinque lobata; semicellulis sub-5-lobatis, lobis lateralibus radiantibus, bilobulatis; lobulis bifidis; lacinulis rectis apice bicuspidatis vel bidentatis; membrana glabra vel subtilissime punctata; sinu interne lineari, externe modice aperto, angusto-cuneato.

Species inter has duas sequentes; difficile est dicere cui harum specierum verisimiliter proxima! *Formæ* duæ:

α. **typica.** Apicibus lobulorum bicuspidatis. T. V, f. 6 a.

Long. 130—145, lat. 104—120, lat. isth. 18, lat. apic. 50, lat. lob. pol. 20 μ.

β. **dentata.** Apicibus lobulorum bidentatis. Fig. 6 b.

Long. 135—140, lat. 115, lat. isth. 18, lat. apic. 54, lat. lob. pol. 19 μ.

(*Mic. crux-melitensis*, Wallich, ex p., Mscr. No. 84, f. 1; Long. 130, lat. 104 μ.

The species occurs in Bengal, but seems uncommon. It is a very close relative of the two following species, but the regularly stellate, not sub-ramose, form at once distinguishes it from them.

13. **M. crux-melitensis,** (Ehr.) Ralfs (Br. Desm. p. 73, t. IX, f. 3; *Euastrum crux-melitensis* Ehr. Abhl. Berl. Ak. p. 81, ex. p. 1831; Inf. p. 162, t. XII, f. 3 a b, non c; Kütz. Phyc. Germ. p. 134; Focke Phys. Stud. p. 64, t. I, f. 13; *Micrasterias melitensis* Mengh. Synopsis p. 216, No. 4; *Euastrum divergens* Bréb. in litt. fide Mengh. l. c.; *M. furcata var.* Wallich Beng. Desm. p. 280).

Collectio Wallichiana varias formas *Micrasteriæ crux-melitensis* copiose continet. Apicibus lobulorum bidentatis, rarissime bicuspidatis.

Forma *α* **typica.** Fere ut in speciminibus Europæis formata.
» *β* **compressa.** Lobulis lateralibus sub-curtis.
» *γ* **minor.** Forma minor, lobo polari parum exserto.
» *δ* **lata.** Latior, in proportione, quam f. typica.
» *ε* **robusta.** Lobulis, et lobo polari, crassis.
» *ζ* **alata.** Forma, lobis valde incisis, expansis; lobo polari parum exserto.
» *η* **gracilis.** Lobis valde incisis, tenuibus; lobo polari magis exserto.

T. V, f. 4. Dimensiones:

	Long.	lat.	lat. isth.	lat. apic.	lat. lob. pol.	
α	112	104	24	38	18 μ	f. 4 a
β	104	84	14	34	15 »	» » b
γ	82	76	13	28	14 »	» » c
δ	118	114	20	42	20 »	» » d
ε	132	118	24	52	25 »	» » e
ζ	104	92	13	35	15 »	» » f
η	100	82	14	32	13 »	» » g

The filamentous condition is illustrated by the locking or interlacing of the 'furcillæ' of the polar lobes, as in fig. 4 h (after Wallich Mscr. No. 84, f. 2): Wallich thinks that the sexually mature fronds cohere by the furcillæ previous to conjugation. A vertical view of the frond is given at T. XIX, f. 17 (crass. 23—26 μ).

Wallich in Mscr. gives the size as long. 81, lat. 78 μ = f. *γ* supra. Vide note sub No. 14.

Bengal; not in other gatherings.

[Since compiling the above list of forms I have found that I have omitted one very peculiar specimen, long. 97, lat. 87 μ, with a distinct tooth 3 μ long on each side of the apical concavity; the frond has dentate lobules. It might stand as f. *ϑ* **evoluta.**]

14. **M. furcata,** RALFS (Br. Desm. p. 73, t. IX, f. 2, non AGARDH; WALLICH Beng. Desm. p. 280, ex p.; *Micrasterias melitensis* RALFS Ann. N. H. vol. XIV, p. 260, t. VI, f. 2, non MENGH.; *M. crux-melitensis* var. b *furcata* RABH. Fl. Eur. Alg. III, p. 190; *M. radiata* HASS. Br. Fr. Alg. p. 386, t. XC, f. 2; *M. melitensis β gracilis*, KÜTZ. Spec. Alg. p. 171). Hæ formæ tres:

Forma *α* **typica.** Fere ut in RALFS l. c.; lobulis lateralibus apice forcipatis.

» *β* **gracillima.** Lobis attenuatis; apicibus lobulorum dentatis; lobo polari paullo exserto.

» *γ* **expansa.** Major; radians; apicibus lobulorum sub-bicuspidatis.

T. V, f. 5. Dimensiones:

	Long.	lat.	lat. isth.	lat. apic.	lat. lob. pol.	
α	145—150	124—130	20	48	22 *μ*	f. 5 a
β	135	120	24	70	22 »	» » b
γ	165—176	140—158	22	86	27 »	» » c

Hab. *β* Bengal; *α* and *γ* Northern India.

[*Note.* Of this species WALLICH, l. c. p. 280, says »abundant and occurs in every state intermediate between the typical one and its variety commonly described under the specific name of *M. crux-melitensis*». From Dr. WALLICH's remarks upon these and other forms, and also upon »divergence» and specific limits (pp. 184—5, 275, 277, etc.) it appears that between 1854 and 1860 he had become an enthusiastic evolutionist, and as such was much inclined to believe that *consimilar* forms were most probably *originally cognate.* Against this view W. ARCHER advanced arguments (Dubl. N. H. Soc. Trans. 1865) urging the persistence of type, i. e. of species, in the Desmidieæ. Both against and for the fusion of species there is much to be said; the *quæstio vexata* will hardly be settled, as Evolution demands generations of forms upon which to effect change, which would require generations of observers to detect and consider. For my own part I express no opinion upon the controversy, except that, as all my figures of the two preceding species (except f. 4 h) are *ad nat.*, the truthfulness of Dr. WALLICH's remarks upon *diversity of form* is amply sustained.]

15. **M. alata,** WALLICH (Desm. Beng. p. 279, t. XIII, f. 11, 1860; LAGERH. Desm. Beng. p. 5; *M. ala-draconis* WALL. Mscr. No. 78, 79). Formæ duæ:

α **typica.** Semicellulæ sub-7-lobatæ; lobis radiantibus, expansis.

β **depressa.** Lobis lateralibus curtis, depressis; lobo polari magis exserto.

Dimensiones:

	Long.	lat.	lat isth.	lt. apic.	lt. lob. pol.	crass.	
α typica	160—174	148—154	14—20	60—66	12.5	28 *μ*.	T. VI, f. 3, 5.
WALLICH l. c.	147	142	—	—	—	— »	
β depressa	152	125	15	50	14.5	— »	T. VI, f. 2.

Baboosole, 22 Oct. 55, G. C. W.

The zygospore of this species was first described by LAGERHEIM (Amer. Desmfl. p. 231, t. XXVII, f. 5), his figure seems to possess rather fewer and thicker spines than the one I noticed. The dimensions given by LAGERH. are Diam. c. acul. 98, s. acul. 58 *μ*; mine (f. 4) give Diam. c. acul. 100, s. acul. 60 *μ*; thus they practically agree except in the thickness of membrane, and, as this varies so much according to the age of the Zygospore, I deem it unimportant.

16. **M. apiculata,** (Ehr.) Mengh. (Synops. Desm. p. 216, 1840; *Euastrum apiculatum* Ehr. Abh. Berl. Ak. p. 245, 1833; Infus. p. 167; l. c. t. XII, f. 2 *E, aculeatum* (pro errore); *Euastrum spinuligerum* Bréb. fide Mengh. l. c.), var. **lacerata,** n. v.

Var. quarta parte minor quam f. typica; lobulis laciniate partitis vel laceratis, irregularibus. Figuræ 1, Tab. V (in Desm. sub-alp.), Delpontii paullulum accedens.

Long. et lat. 185, lat. isth. 30, lat. apic. 84, lat. lob. pol. 44 μ. T. XXII, f. 3.

The inferior lobes somewhat resemble the sub-alpine form; the polar lobe is more like that of the English plant; cfr my fig. in Cooke's Br. Desm. t. 48 a b (non c! which is after Delp. l. c. f. 2).

Khasia, ex utriculariis, G. von L. comm.

Dr. Nordstedt (Desm. Bornh. pp. 187—90 et 212) propounds an ingenious theory that the plants described as *M. fimbriata* Ralfs (Br. Desm. p. 71, t. VIII, f. 2); *idem v. ornata* Bulnheim (Hedw. II, p. 21, t. II, f. 3, 1859); *idem* (sub nomine *M. aculeata*) Rostock in Rabh. Alg. Europ. No. 1856; Hedw. II, p. 59; *M. brachyptera* Lund. (Desm. Suec. p. 12, t. I, f. 4); *M. Halis* Racib. (Desm. Polon. p. 40, t. V (XIV), f. 1); with certain forms of these, are but varieties and forms of the above species. I would remark that not only is the retention of some of these as species a matter of scientific convenience, but the correctness of their proposed fusion is only conjectural, their respective zygospores being unknown; it therefore seems inexpedient to change their status under existing knowledge of them. As to Bulnheim's and Rostock's varieties (and *M. Halis* also?) it seems probable that they do naturally fall under this species, but with respect to *M. fimbriata* and *M. brachyptera*, although no doubt they are allies of Ehrenberg's plant, it seems to me that they should continue to retain their specific rank.

17. **M. foliacea,** Bailey (in Ralfs Br. Desm. p. 210, t. XXXV, f. 3; Wallich Desm. Beng. p. 280). Formæ duæ:

α. **typica.** Frons lata vel latior quam longa. T. VI, f. 12—14.

β. **elongata.** Frons longior quam lata (var. β Wallich, l. c. t. XIV, f. I).

Dimensiones:

	Long.	lat.	lat. isth.	lat. apic.	lat. lob. pol.	crass.
α	70—73	72—78	12—14	30—32	10—12	12 μ.
β	85—90	70—75	11—13	32	15	— »
Wallich »	85	72	—	—	—	— »

The type alone appears in Wallich's Mscr. of 1855 (Nos. 70, 85, 88), under the name *Micrasterias armilla;* it seems that his figure in Beng. Desm. was drawn from the other form. Wallich states that in the young zygospore the spines are simply conico-aculeate; in the mature zygospore they are bi- or tri-furcate at their apices. It is not rare to find this species in cateniform filaments of 50 or even 70 fronds. Nordstedt's *var. γ ornata* (with aculei on the incisions), found in Brazil (Desm. Bras. p. 221, t. II, f. 16) is, like var. β supra, longer than broad. The Zygospore (f. 15 Nob.) has Diam. s. spin. 45, c. spin. 78 μ.

Bengal (Elephant Tank, Nov.), G. C. W., 1855; British Burmah, ex *Utricularia fasciculata*; also from Khasia, ex *Utr. sp.*, comm. G. VON L., 1889.

18. **M. Mahabuleshwarensis,** HOBSON (Notes on Indian Desm., Q. J. M. Sci., p. 168, 1863; LUNDELL, Desm. Suec. p. 15, t. I, f. 6, 1871; *M. Americana f. Mahabuleshwarensis* MASKELL, On *M. Amer.* p. 9, t. II, f. 8, 1888).

Long. 155—160, lat. 125—140, lat. isth. 26, lat. apic. 80—86, lat. lob. pol. 21—24, crass. 36 μ.

LUNDELL gives long. 170—220, lat. 160—190, lat. isth. 20, lat. apic. 110, lat. lob. pol. 28, crass. 40 μ.

From a *large* Indian specimen long. 164, lat. 144, lat. isth. 24, lat. apic. 91, lat. lob. pol. 24 μ.

Swedish specimen long. 214, lat. 210, lat. isth. 24, lat. apic. 112, lat. lob. pol. 29 μ.

From these comparisons it will be seen that the European forms are much larger than the Indian type, still they resemble it in all points. The last dimension is from a beautiful Swedish specimen, kindly communicated by Dr. NORDSTEDT. I cannot agree with Mr. MASKELL's suggestion that this and other correlated plants should be fused as forms of *M. Americana* (and in this view he coincides with WALLICH), as the general habit of the fronds in outline differs so much, and the zygospores being unknown, absolute proof is as yet impossible.

T. VI, f. 1. *Hab.* Central India, J. S.

— — var. **excelsior** (WALLICH) nobis (*M. excelsior*, WALL. Mscr. No. 81, 1855; *M. morsa var. δ*, WALL. Desm. Beng. 1860, p. 277, t. XIII, f. 10; *M. Americana f. excelsior*, MASKELL, l. c. f. 7). Var. tumore centrali carente vel parvo; lobi centrales duplices ut in f. typica, sed incisuræ parte interne emarginato-pinnatæ, non simpliciter aculeatæ; processubus lobi polaris erectis non obliquatis nec expansis. Margines omnes versus aculeata, aculeis seriatim ordinatis.

Long. 130—145, lat. 125—135, lat. isth. 20—25, lat. apic. 55—62, lat. lob. pol. 20 μ. T. V, f. 2 (after WALLICH).

Hab. Raneegunge, Nov. G. C. W.

Continuing my remarks, I certainly think Dr. WALLICH is in error when classing this so closely with *M. Americana*, *M. Baileyi* (RALFS), and *M. ringens* (BAIL.); yet it must be admitted that if the salient points of the specimen of *M. ringens* figured by WOLLE (Desm. U. S. t. XXXV, f. 2) were existent in his other plant, *var. serrulata* WOLLE (Fr. Alg. U. S. p. 41, t. LIX, f. 15) the result would be *M. Mahabuleshwarensis*, minus the 2 intermediate apical processes. As the Desmidieæ are so eminently erratic in form, I venture to predict that the finding of such a form as suggested is but a question of search, and that it will be found!

19. **M. Wallichii,** GRUNOW (Desm. Insel Banka, in RABH. Beitr. II, p. 14, t. II, f. 21; in RABH. Alg. No. 1727; LUNDELL Desm. Suec. p. 15; *M. Americana forma Wallichii*, MASKELL, l. c. f. 9, 10).

Long. 132—154, lat. 120—140, lat. isth. 21—24, lat. apic. 62—73, lat. lob. pol. 24—27 μ.

GRUNOW gives long. 133, lat. 115, lat. apic 75, lat. lob. pol. 20—22 μ.

Lundell gives long. 224, lat. 208 μ.

Specimen from Vestrogothia, O. N. leg. Long. 224, lat. 216, lat. isth. 29, lat. apic. 134, lat. lob. pol. 30 μ.

The last was a very fine specimen sent to me by Dr. Nordstedt. Here again the Indian forms appear to be so much smaller, that the European plants cited, in this and the last-named species, might stand as »β major».

I have not seen any specimen with nearly so extended a ventral process (either in No. 18 type, or this species) as that described by Lagerheim (Desm. Beng. p. 5, t. I, f. 1) under the name of *M. Mahabuleshwarensis var. β surculifera.*

Hydrabad, J. S.

Note. Nordstedt, in Fr. Alg. N. Z. pp. 30—31, has given an interesting resumé of his own and Grunow's views (Rabh.'s Beitr. p. 14) upon this species and the preceding one. My own arrangement stands thus:

M. Mahabuleshwarensis, Hobs. Lobis lateralibus bi-sectis, duplicibus.
α. Lobulis plus minus regulariter attenuatis.
1. *f. typica* (Indica minor) Hobs. l. 127, lt. 105 μ.
2. » » (» intermedia) Nordst. (Alg. Char. p. 10), l. 140, lt. 114 μ.
3. » » (» major) Turner, ut supra, l. 155—164, lt. 125—144 μ.
4. » *brevior* (Americana) Nordst. (N. Z. p. 31), l. 105, lt. 83 μ.
5. » *Europæa* Nordst. (Lund. Desm. Suec.), l. 170—220, lt. 160—190 μ.
β. Lobulis plus minus lageniformibus.
6. *f. Novizelandica,* Nordst. (N. Z. l. c.), l. 200, lat. 160 μ. (Mask. t. XI, f. 7).
γ. Lobulis introrsum aculeato-emarginatis; attenuatis.
7. *var. excelsior* (Wall.) Turner, l. 130—145, lt. 125—135 μ.

M. Wallichii, Grunow. Lobis lateralibus tri-partitis, vel triplicibus.
α. Lobulis plus minus regulariter attenuatis.
1. *f. typica* (Indica) Grunow. l. 133, lt. 115 μ.
2. *f. major* (Europæa) Nordst. (Lund. Des. Suec.), l. 224, lt. 208 μ.
β. Lobulis plus minus lageniformibus. (Var. *Hermanniana,* Reinsch; *M. Hermanniana,* Rnsch, Alg. Frank. t. VIII, f. 1; Sp. Alg. Fung. t. XXI, f. B.)
3. *var. Hermanniana,* Reinsch l. c. l. 200, lt. 154 μ.
4. — — *f. ampullacea* (Mask. N. Z. f. 6) l. 200, lt. 154 (*M. Mahabuleshwarensis β ampullacea,* Nordst. N. Z. t. II, f. 16 c).
5. — — *f. Fijiensis,* Nob. (Macdonald, Mscr. et litt. ad W. B. T. c. ic. Fiji, 1856); Maskell (On *M. Americana,* t. II, f. 12), l. 200, lt. 160 μ, »f. incisuris brevioribus».
6. *f. Spencerii,* Nob. »marginibus non serratis» = *M. ampullacea* Mask. *var. β* Spencer (N Z Desm. p. 296, t. XXIII, f. 6), l. 128, lt. 96 μ.

The fig. of Wolle (Desm. U. S. A. t. 32, f. 5) *M. Americana v. Hermanniana* (Wolle), cited by Nordstedt in Fr. Alg. N. Z. p. 31 as a form of these species, seems to me only a deeply incised form of *M. Americana* Ehrb.; and it might probably be better to call it *f. incisa* of that species. It is not the M. Hermanniana of Reinsch, as the lobules are not lageniform.

20. **M. Americana** (Ehr.) Ralfs (Br. Desm. p. XIX, in errata». (*M. morsa*) p. 74, t. X, f. 1; Kütz Sp. Alg. No. 5, 171; *Euastrum Americanum* Ehrb. Verbr. Amer. p. 125, t. IV, f. 15; *Euastrum* (No. 4) Bailey, Amer. Bacill. p. 295, t. I, f. 25, cfr Ehrb. l. c. p. 46!; M. Americana (formæ variæ) Maskell, l. c. f. 1—6, non 7—14).

Forma ut in var. *α* (typica) Ralfs l. c., sed minor; membrana obscure punctata.

Long. 100—118, lat. 86—92, lat. isth. 18—20, lat. apic 50—54, lat. bas. lob. pol. 22—27 *μ*.

Northern India, J. S.

21. **M. anomala** Turner (in litt. 1883; *M. apiculata forma* Joshua? Burm. Desm. p. 636, t. XXII, f. 13 *idem* f. *Joshuæ*, De Toni et Levi, Notarisia p. 91, 1886).

M. magna, egregia, anomala, circ. quarta parte longior quam lata, late elliptica, sinu profundo, lineari, angusto: semicellulæ quinquelobæ, lobis lateralibus bi-lobulatis, sub-radiantibus, incisuræ interne plus minus acuto-rotundatæ, apicibus lobulorum 2-3—4-dentatis; marginem versus utroque latere processubus duobus, et circa ventrem semicellulæ processubus 4, brevibus, tubiformibus dentatis armatis, scrobiculum magnum vel processum cingentibus; lobo polari exserto, cuneato, apice incavato, angulis in 4—6 processus divergentes tubiformes dentatos fissis, basi processubus duobus consimilibus brevibus, munito. Membrana punctata? A latere visa modice constricta, semicellulis lanceolato-attenuatis, apice rotundatis; processubus prominentibus.

Var. **irregularis**. F. lobis lateralibus irregulariter divisis; quoque in 3—4—5 lobulis secto.

Long. 190—210, lat. 145—160, lat. isth. 37—42, lat. apic. 74—90, lat. bas. lob. pol. 34—40, crass. circ. 54 *μ*. T. XXII, f. 1.

Hab. Khasia, super Brahmaputra flumen, ex *Utriculariis;* also E. India, ex *Utricularia fasciculata*, G. v. L. 1889; Northern India, 1883, J. S.

This is a very anomalous and extraordinary plant, of which I have seen but 5 specimens, the variety of which in the divisions of the lateral and the angles of the polar lobes is astonishing. It seems as though the frond was in general outline nearest to *M. Americana*, with the lobules and projections (tubular!) of *Xanthidium armatum* superadded! However, this species stands alone, being much unlike any other member of the genus. The specimen I had in 1883 was only part of decayed semicell, so I could not describe it. The nearest approach to this Desmid is the *M. apiculata forma* (*f. Joshuæ* De Toni) of Joshua in his Burm. Desm. p. 636, t. XXII, f. 13, which almost seems to be an erratic form of this plant.

22. **M. Khasiæ**, n. sp. M. mediocris, diametro paullo longior, medio modice constricta, sinu lineari; semicellulis 5-lobatis, lobis sinu lineari inter se discretis, lobo polari lato brevi apice incavato valde expanso non exserto spinis brevibus curvatis crassis armato; lobuli laterates non æquilati, superioribus latioribus quam inferioribus et basalibus, apicibus bisectis acutis, apicibus lobulorum 2 basalium et 2 superiorum aculeis parvis munitis; membrana glabra? sed cum papillis parvis conicis sparsis paucis brevibus apice rotundatis ornata. Species, ut mihi visa, inter *M. apiculata* Ehr. et *M. mammillata* Nob. (On Desm. p. 936, t. XVI, f. 12, reduced!), sed multo minor, et non æque gra-

cilis. Etiam prope *M. Holi* RAC. (Desm. Polon. p. 40, T. XIV, f. 1) sed superficies et apicibus lobulorum non mucronatis vel aculeatis.

Long. 184, lat. 164 μ. T. XXIII, f. 2.

KHASIA, ut supra, comm. G. VON L. 1889.

In this species, which is much smaller than *M. mammillata* NOB., the papillæ are conical and quite round at their apices; it differs from the species named in having the lobules acute and not rounded-off, with the exception of the superior and inferior pairs of lobules, which are one-spined. The polar lobe is in form much like that of *M. apiculata*.

This genus seems to contain but four principal types, which I would range under the fellowing sub-genera:

A. **Holocystis** (HASSALL) emend. (*ολος*, integer, *κυστις*, cellula) lobis polaribus indivisis; lobis lateralibus transverse positis.

Typ. spec. M. truncata; M. oscitans; M. pinnatifida; M. incisa.

B. **Atomocystis** (*ατομος*, non sectus; &c.) lobis polaribus vix vel non divisis; lobis lateralibus normaliter singulis radiantibus.

Typ. spec. M. expansa, BAIL.; M. stauromorpha, NOB.; M. tropica, NORDST.

C. **Actinocystis** (*ακτιν*, radius solis; &c.) lobis polaribus furcatis; lobis lateralibus radiantibus.

Typ. spec. M. rotata; M. crux-melitensis, EHR.; M. lux, JOSH.

D. **Schizocystis** (*σχίζω*, scindo; &c.) lobis polaribus indistincte furcatis; lobis lateralibus sub-radiantibus irregulariter positis; frons sæpe radiis vel processubus instructa.

Typ. spec. M. Nordstedtiana; M. muricata; M. anomala, NOB.

Of these sub-genera Holocystis falls nearest to *Euastrum* (*Eucosmium*), while *Schizocystis* comes near Xanthidium. The discovery of a triangular form of *Micr. pinnatifida* (*var. trigona*, W. W.), by my friend W. West, is of great interest, as giving another decided connecting-link between this genus and its successors (cfr J. BOT., Oct. 1889, t. 291, f. 15).

Gen. 18. Xanthidium, EHRB.

(Abb. d. Berl. Akad., p. 317, 1833, Ber. d. Berl. Akad. 1836, mut. char; RALFS in Annals N. H. vol. XIV, p. 466, 1844—5.

1. **X. cosmariforme**, n. sp. X. submediocre, circ. 1½-plo longius quam latius, »cosmariforme»; late ovale; semicellulæ semicirculares, in centro tumore parvo instructæ, angulis rotundatæ margine aculeis parvis (circ. 15) preditæ; superficie tumoris granulata; sinu lineari, sub-angusto, extrorsum parum ampliato; membrana achroa vel fuscopallescenti. A latere visum lanceolatum, paullo constrictum, apicibus rotundatis, aculeis in seriem verticalem ordinatis.

Long. 39, lat. 27, lat. isth. 10, crass. 16, long. acul. 1.7—3 μ. T. XII, f. 17.

F. **evoluta**. Series 3, non 1, aculeorum margine; a latere visum series verticales 3, habens.

Long. 37, lat. 27, lat. isth. 10 μ. T. IX, f. 9.

I referred this and Cos. sp. (C. puteale, No. 125) to Dr Nordstedt, who remarks »the differences between certain *Cosmaria* and *Xanthidia* are wery small, . . . I have often thought that we must again take up Reinsch's genus *Didymidium*» (a very multifarious genus!); and I must own that this might just as correctly be called *Cos. xanthidiforme* as by the above name! Cfr suggestion by me as to sub-genera.

[In the dimensions of this genus, long, and lat., the spines are included].

2. **X. cristatum**, Bréb. (in Ralfs Br. Desm. p. 115, t. XIX, f. 3 a, b, c).

Long. 80, lat. 70, lat. isth. 16, long. spin. 14—17 μ. T. XII, f. 20.

F. **inornata**, n. f. F. ventre vix inflato; membrana punctata.

Long. 74, lat. 68, lat. isth. 15, long. spin. 10—12 μ. Fig. 18.

Var. **leiodermum**. Minor; semicellulæ distincte octagonæ. (*X. leiodermum* Roy & Bisset, Jap. Desm. t. 268, f. 11).

Long. 78, lat. 65, lat. isth. 14, l. spin. 10—14 μ. Fig. 33.

— — F. **irregularis**. F. spinis lateralibus irregulariter positis.

Long. 84, lat. 70, lat. isth. 11, l. spin. 10—13 μ. Fig. 31; T. XIII, f. 3, oblique.

F. **inevoluta**. Fere ut in *X. leiodermum*, sed apice et basi spinis singulis, angulis superioribus lateralibus spinis geminatis, armata.

Long. 76, lat. 64, isth. 13, l. spin. 11 μ. T. XII, f. 27.

Var. **erectum**. Semicellulæ margine superiore indistincte 4-angulatæ, fere semicirculares, spinis dorsalibus erectis.

Long. 74, lat. 76, lat. isth. 14, l. spin. 12—14 μ. T. XIII, f. 5.

3. **X. bisenarium**, Ehr. (Verbr. Amer. pp. 46, 51 et 138, »Icon Baileyi, 1841»; *Euastrum* No. 11, Bailey Am. Bacill. p. 291, t. I, f. 13; *X. cristatum β uncinatum*, et *X. uncinatum*, Breb. in Ralfs Br. Desm., p. 115, t. XIX, f. 3 d e f.

F. **typica**. Angulis basalibus 1—2 aculeatis. Long. 82, lat. 68, lat. isth. 16, l. spin. 9—11 μ. T. XII, f. 30.

Var. **rotundatum**. Semicellulæ rotundato-octagonæ, non elongatæ.

Long. 70, lat. 54, lat. isth. 16, l. spin. 6—11 μ. Fig. 28.

Var. **ornatum**. Semicellulæ paullo protensæ, granulis et tuberculis 5—6 supra protuberantiam centalem curvatim dispositis; a latere bi-ovale, modice constrictum, apicibus rotundatis.

Long. 70—80, lat. 62—76, lat. isth. 13, crass. 25, l. spin. 10 μ. T. XIII, f. 2.

I can hardly coincide with the usual view that this is but a sub-species of *X. cristatum*, as the form of the cells and the direction of the spines so widely differ from that plant, moreover Ehrenberg's name has decided priority. The form described by Wolle (Desm. U. S. A. p. 93, t. XXIII, f. 7—9) is certainly *X. Brebissonii*, Ralfs, and not *X. bisenarium*. I am aware that I am venturing to differ with various learned authors respecting this species, but, as I have many specimens of *X. cristatum* with basal aculei *binary*, I can but accept Ehrenberg's remark, especially as the *form* of *frond* (a greater point than one spine more or less!) agrees with the figures cited of Ralfs & accepted by Brébisson.

Northern India.

4. **X. fasciculatum** Ehr. (Infus. p. 146, ex p., t. X, f. 24 b; Ralfs in Annals N. H. p. 466, t. XII, f. 3 e; *Euastrum fasciculatum* Kütz. Phyc. Germ. ex. p., p. 137; *X. fasciculatum*, Hass. Br. Alg. p. 359, pro. max. parte; Ralfs Br. Desm. p. 114; ex. p., t. XIX, f. 4).

Long. 72, lat. 70, lat. isth. 12, l. spin. 11 μ. T. XII, f. 34.

Northern India, J. S.; East India, ex *Utricularia fasciculata*, G. von L.

5. **X. antilopæum** (Bréb.) Kütz. (Spec. Alg. p. 177, 1849; *Cosmarium antilopæum*, Bréb. in Menegh. Synops. p. 218; *Euastrum*, No. 10, Bailey Amer. Bacill. p. 296, t. I, f. 10; *Euastrum fasciculatum*, Kütz. Phyc. Germ. p. 137, ex. p.; *X. polygonum* Hassall, Br. Fr. Alg. p. 360 (excl. syn.), t. 89, f. 4; *X. fasciculatum*, Ralfs ex. p. Br. Desm. t. XX, f. 1 a, c; *X. fasciculatum β polygonum*, Ehr. Inf. p. 146, ex. p., t. X, f. 24 a; Ralfs in Annals N. H., vol. XIV, p. 467, t. XII, f. 3 a b c d). **Var. δ polymazum** Nordst. (Norg. Desm. p. 38, t. I, f. 20). F. **major,** n. f. **Membrana punctata.**

Long. 84—90, lat. 85—96, lat. isth. 17—20, long. spin. 12 μ. T. XIII, f. 1.

F. **depressa.** Semicellulis paullo depressis, ventre non inflatis.

Long. 64, lat. 86, lat. isth. 24, l. spin. 12 μ. T. XII, f. 24.

Northern India; Neilghiri Hills?

6. **X. hastiferum,** Turner (On Desm. p. 938, t. XV, f. 20, 1885; *Xanth. antilopæum var. angulatum* Josh. Burm. Desm. p. 643, t. XXIV, f. 16, 1886: *X. angulatum* (Josh.) Lagerh. Krit. Bemerk. p. 539).

F. **typica.** Long. 53, lat. 76, lat. isth. 12, l. spin. max. 17; min. 3.5 μ. T. XII, f. 25.

Bengal; Himalayas, ex. *Utricularia stellari*, G. von L.

Var. **Javanicum** (Nordst.) Nob. (X. antilopæum f. Javanica, Nordst. Alg. Char. p. 12, t. I. f. 21).

F. **plana.** Semicellulæ dorso fere planæ. (Wallich Mscr. No. 175 B).

Long. 64, lat. 84, lat. isth. 12, long. spin. 12—20 μ. T. XII, f. 23.
» 60, » 60, » » 11, » » 11 μ. T. XIII, f. 6.

F. **angulata.** Semicellulæ reniforme-octagonæ.

Long. 55—65, lat. 66—72, lat. isth. 11—13, crass. 18—22, l. spin. 12—14 μ. T. XII, f. 16; fig. 19, a latere; forma paullo irregularis.

— — An abnormal division. The old frond seems to have divided, one segment developing properly, and the other remaining undeveloped and fixed between the dorsal spines of the sister cell! Both partly occupied by vibratile granules which were red in colour. T. XII, f. 22, after Wallich Mscr. No. 175 A.

Note. From the description (Contrib. Alg. fung. p. 92) I almost imagine that this sp. is really = *X. Nordstedtianum* Reinsch, but his figure (T. X, f. 6) does not agree with the text, »anguli quatuor spinis tenuioribus *binis* armati, anguli laterales spino *singulo* armati». Figure bad?

7. **X. Bengalicum,** n. sp. X. submagnum, tam longum quam latum; semicellulæ angulato-reniformes, margine spinis magnis sex armatæ; angulis basalibus nudis, rotundatis; tumore ventrali nullo; quaque semicellula nucleis amylaceis binis prædita; sinu profundo,

sub-lineari, modice aperto: membrana glabra, vel obscure punctata. A vertice visum angusto-ellipticum.

Long. 70, lat. 74, lat. isth. 12, l. spin. 10—13 μ. T. XII, f. 32, after WALLICH Mscr No. 174.

Speciei præcedenti proxime accedit.

8. **X. hexacanthum**, n, sp. X. mediocre, fere tam longum quam latum; semicellulæ late octagonæ, angulis externis spinis rectis singulis longis 6 armatis; ventre tumidæ, congerie circulari verrucarum ornato; membrana punctata; sinu profundo, sublineari, extrorsum valde ampliato.

Long. 77, lat. 72, lat. isth. 13, long. spin. 9—13 μ. T. XII, f. 26.

Near to *X. Nordstedtianum* REINSCH, and to the preceding species.

9. **X. tetracanthum**, n. sp. X. submediocre, tam longum quam latum; semicellulæ irregulariter quadrangulares, basali parte laterum inflata; membrana glabra, ventre tumida, annulo granolorum ornata; sinu acuto, aperto, interne rotundato. Quaquæ semicellula angulis externis spinis 4 rectis vel leniter curvatis singulatim positis armata.

Long. 67, lat. 68, lat. isth. 13, long. spin. 7.5 μ. T. XII, f. 29.

Arguing from analogy with such a form as this, undoubtedly a *Xanthidium*, would prevent the well known form (though absent from these gatherings) *X. octocorne* EHR., from being often misplaced under *Arthrodesmus!*

10. **X. ineptum**, n. sp, X. minutum, tam longum quam latum (sp. inclus.); semicellulæ ovales, margine rotundatæ, dorso paullo depressæ; lateribus (quibusque) spinulis 3 armatis, irregulariter positis; sinu brevi, aperto; membrana glabra? A latere visum biovatum, lateribus non tumoribus munitum.

Long. 11—12, lat. c. spin. 11—13, lat. isth. 3—3.5, crass. 4—4.5, l. spin. 1.5—2 μ. T. XII, f. 21, after WALLICH Mscr. No. 286.

11. **X. Searsolense**, n. sp. X. parvum, Cosmariiforme, quinta parte longius quam latum, late ovale; semicellulæ sub-semicirculares, dorso truncatæ; quaque semicellula in centrum nodulis parvis verticaliter positis prædita; et apud apices processubus duobus (4 a latere et a vert. visis) emarginatis munita; margine aculeis parvis, utroque latere 6—7, armata; membrana glabra; sinu lineari, angusto, extrorsum parum ampliato. A' latere visum clepsydriforme, apicibus truncatis; aculeis in seriebus duabus visis. A vertice ellipticum.

Long. 26—29, lat. 23 (sp. incl.), lat. isth. 7, crass. 15, long. spin. 0.7—1.3 μ. T. XIII, f. 8, after WALLICH Mscr. No. 130.

It is doubtful wheter this is a Cosmarium or Xanthidium, but the aculei seem to relegate it to the latter genus. Cfr proposed new sub-genus *Micracanthum*.

12. **X. brevicorne**, n. sp. X. mediocre, cosmariiforme, tam longum quam latum; subcirculare; semicellulæ ovales, lateribus seriebus 2 aculeorum brevium armatæ, apicali parte glabræ; membrana ut mihi visa glabra; sinu brevi, sub-acuto, rotundato. A vertice visum ellipticum; a latere modice constrictum, semicellulæ globosæ, aculeis in lineas 2 verticales ordinatis. Semicellulæ ventre non tumescentes.

Long. 56, lat. sp. incl. 52, lat. isth. 26, long. spin. 2.5 μ. T. XIII, f. 9.

Central India

13. **X. pulchrum,** n. sp. X. mediocre, cosmariiforme, tam longum quam latum, subcirculare; semicellulæ ovales, lateribus in superiorem partem quoque latere aculeis brevibus crassis 3, et basin versus aculeis consimilibus circ. 10 irregulariter positis (ad marginem), armatæ; superficie punctata, centrali parte juxta isthmum glabra, et supra isthmum stigmatibus vel scrobiculis parvis 12—14 transverse dispositis ornata; sinu aperto, cuneato, interne rotundato. Tumor ventralis nullus. A vertice visum ovato-ellipticum.

Long. 56, lat, 54 sp. incl. lat. isth. 25, crass. 28, l. spin. 3—4 μ. T. XIII, f. 10.

Central India.

14. **X. eximium,** n. sp. X. mediocre, paullo longius quam latius, sub-circulare; semicellulæ ovatæ, aculeis brevibus crassis (in quaque semicellula circ. 10) marginalibus et intra margines serie aculeorum consimili armatæ; membrana punctata: sinu brevi, aperto, interne rotundato. A latere visum bi-globulatum, aculeos in series verticales 3 habens.

Long. 56, lat. 50 sp. inclus., lat. isth. 26, crass. 30, long. acul. 3 μ. T. XIII, f. 12; XXII, f. 10.

Central India.

15. **X. Raneegungense,** n. sp. X. sub-magnum, tam longum quam latum, sub-circulare; semicellulæ ovales vel ellipticæ, margine et marginem versus aculeatæ; aculeis conico-acutis crassis magnitudine irregularibus et irregulariter positis; tumor ventralis nullus; reliqua membrana glabra; sinu profundo, lineari, angusto, extrorsum ampliato. A vertice visum ellipticum. Quaque semicellula corpusculis amylaceis duobus instructa.

Long. 62, lat. 60 (sp. incl.); lat. isth. 12, crass. 32, l. spin. 6—10 μ. T. XIII, f. 11 (also in Wallich Mscr. No. 127).

Central India; Bengal.

16. **X. torquatum,** n. sp. X. mediocre, circ. quinta parte longius quam latum, fere circulare, cosmariiforme; semicellulæ sub-semicirculares, angulis basalibus rotundatæ, margines versus gemmulis verrucosis ordinibus 2 positis ornatæ (unica a fronte visa), et margine inter ordines gemmulorum aculeis brevibus crassis 4 armatæ; sinu angusto, profundo, extrorsum parum ampliato. Quaque semicellula in centro tumore granulato circulari instructa, reliqua membrana glabra. A vertice visum latera tumida, apices truncatæ rectæ.

Long. 55, lat. 45, lat. isth. 10, crass. 25, long spin. 5 μ. T. XXII, f. 8.

Northern India.

17. **X. armatum,** Bréb. (Ehrb. Berl. Monatsber. 1840, as *Zygoxanthium echinus;* Kütz, Sp. Alg. p. 178; *X. echinus* Ehrb. Berl. Nat. Gesellsch. 18 June 1839, fide Kütz, l. c. [sp. ined.?]; *Heterocarpella armata* Bréb. in Chev. Micr. p. 272, 1839, nomen solum!; *Cosmarium armatum* Bréb. in litt. c. ic., fide Mengh. 1839; Mengh. Synops. p. 218, 1840; *Euastrum armatum* Kütz. Phyc. Germ. p. 137; *X. furcatum* Ralfs Annals N. H. vol. XIV, p. 466, t. XII, f. 1, non Ehrb.; *X. armatum*, Bréb. in Ralfs Br. Desm. p. 112, t. XVIII, a—g). Var. *incongruum*, n. v. Margine 14 (non 12 ut in a) spinas, et circiter scrobiculum centralem 4 consimiles breves, fissas habens; spinis (vel

processubus) trifidis vel quadrifidis; membrana punctata. Magis minus quam f. typica, paullo *X. armato β basidentato* NORDST. (N. Z. Alg. p. 42, t. IV, f. 21) consimile.

Long. 104, lat. 80, lat. isth. 34, long. proc. 8 μ. Taf. XIII, f. 4.

This, like NORDSTEDT's New Zealand form is much smaller than the type, it differs from the latter in having 2 apical processes & 4 placed around and equidistant from the scrobiculus.

Khasia, super Brahmaputra flumen, ex. *Utricularia sp.*, comm. G. VON L.

The sub-genera of this genus, Holacanthum and Schizacanthum, proposed by LUNDELL, Desm. Suec. pp. 74—5, 1871, are admirable, but they do not meet the requirements of certain forms which have been considered as 'aculeate Cosmaria'. I hold with RALFS that no aculeate form is a true Cosmarium, hence I would add anoother sub-genus, the sub-genera standing thus:

A. **Schizacanthum,** LUND., l. ,c.

Typ. sp. X. armatum.

B. **Holacanthum,** LUND., l. c.

Typ. sp. X. cristatum, fasciculatum, acanthophorum.

C. **Micracanthum,** n. s. g. *μικρος*, parvus; *ακανθα*, spina). Cellulæ cum vel sine tumore centrali; spinis vel aculeis parvis, non elongatis, munitæ.

Typ. sp. X. cosmariforme, nob.; X. (Cos.) armatum JOSH. ex. p. f. 24, 25. Burm. Desm.; X. torquatum, nob.

I would not include under this sub-genus such a form as Cos. ovale RALFS, as in that the projections are only dentate, not aculeate or spinous; yet the distinction between a 'tooth' and one of the shorter, spines' is somewhat difficult. The ventral projection in this genus is frequently absent, and when it does not appear its absence tends to confuse the observer.

[As most of this little memoir was written long ago, I have been asked, »Do the suggestions of BOLDT (Desm. Grönl. p. 31 separ. 1888), conflict with your views?» To this I reply, that Dr BOLDT's sub-genera are founded solely upon the character, and distribution in the cell, of the chlorophyll — and that, as I have elected to sketch an outline of a classification (partly experimental) based on exterior form alone, our views do not conflict in any way. Of course, sec. LUNDELL, I should place that charming species *X. Grœnlandicum*, BOLDT l. c., from its form, under *Schizacanthum*, as the processes thereon appear to be something more than what its author styles *verrucæ*.]

Gen. 19. Staurastrum, MEYEN, 1828.

(In Nova Acta vol. XIV, Pt. II, p. 777, 1829; *Desmidium*, EHR. Inf. ex. p. [et *Pentasterias*]; MENGH. Synops. p. 224 (excl. *Arthrodesmus* EHR.); *Phycastrum*, KÜTZ. Phyc. Germ. p. 137; *Goniocystis*, (*Trigonocystis*, *Staurastrum* et *Pentasterias*) HASSALL, Br. Fr. Alg. p. 349; *Phycastrum*, *Asteroxanthium* et *Stephanoxanthium*, KUTZ Sp. Alg. 1849; *Phycastrum*, (*Amblyactinium*, *Pachyactinium* et *Stenactinium*) NÄG. Einz. Alg. 1849; *Staurastrum*, RALFS Br. Desm. (char. emend.) p. 119, 1848; *Didymidium* sub. gen. *Staurastrum* REINSCH, Alg. Frank. p. 150, 1867; *Didymocladon* RALFS Br. Desm. p. 144, includ.).

1. **S. smaragdinum,** n. sp. S. minus, fere tam longum quam latum, late ovale; semicellulæ late semicirculares, angulis basalibus et dorso rotundatis; membrana dense

punctata; sinu profundo, angustissimo-lineari. A vertice visum triangulare, lateribus paullo incurvatis, angulis acuto-rotundatis. Zygospora globosa, aculeis longis acutis basi conicis armata, circ. 6 in fascia marginali positis.

Long. 22—24, lat. 20—22, lat. isth. 5.5—6; Zygospora c. acul. 65, s. ac. 45 μ. T. XIII, f. 14 (after WALLICH Mscr. No. 277), × 800.

Near to *Stau.* (*Phyc.*) *depressum* NÄG. Gatt. einz. Alg. t. VIII A, f. 1, but larger and punctate.

2. **S. orbiculare,** (EHR.) RALFS (Annals N. H. vol. XV, p. 152, t. X. f. 4, 1845; Br. Desm. p. 125, t. XXI, f. 5; *Desmidium orbiculare,* EHR. Abh. Berl. Akad. p. 292, 1833; Infus. p. 141, t. X, f. 9; *Phycastrum orbiculare,* KÜTZ. Phyc. Germ. p. 137, 1845; Sp. Alg. p. 178; *Goniocystis* (*Trigonocystis*) *orbiculare,* HASSALL Br. Fr. Alg. p. 349).

1. Long. 28, lat. 24, lat. isth. 8 μ.
2. » 26, » 26, » » 7 μ. T. XVI, f. 40, × 900; after WALLICH Mscr. No. 270.

Hab. 1. Northern India; 2. Raneegunge, July 1855 G. C. W.; I have also seen a typical form ex *Utricularia flexuosa* from East Bengal, communicated by G. VON L.

In the Indian specimens the sinus is very narrow, the semicells being closely adpressed. »Frond very minutely punctate», G. C. W.

3. **S. retusum,** n. sp. S. minus, tam longum quam latum, magnitudine variabili, truncato-ovale; semicellulæ depresso-ovatæ, lateribus sub-acutis, angulis superioribus et basalibus rotundatis; dorso retusæ; glabræ?; sinu profundo, lineari, extrorsum parum ampliato. A vertice visum triangulare, partibus medianis laterum leniter incurvatis, angulis acuto-rotundatis. Massa chlorophyllacea axilis, radiata, apud angulos divisa.

Long. et lat. 20—30, lat. isth. 6.5—10 μ. T. XIII, f. 13, after WALLICH Mscr. No. 271.

. **S. depressum,** NÄG. (Phycastrum depressum NÄG. Einz. Alg. p. 126, t. VIII, A. f. 1, 1849; *S. muticum f. minor,* LUND. Desm. Suec. p. 56).

Forma **aperta,** n. f. Fere ut in f. typica, sed sinu magno, aperto, interne rotundato; major.

Long. 26, lat. 25, lat. isth. 10 μ. T. XIII, f. 19, after WALLICH Mscr No. 280 A.

5. **S. punctulatum,** BRÉB. (in RALFS Br. Desm. p. 133, t. XXII, f. 1, 1848; Liste, p. 144).

Long. 32, lat. 31, lat. isth. 10 μ. T. XVI, f. 4.
» 34, » 32, » » 10 μ.

The Indian forms are shorter and broader than the English specimens of RALFS, their angles are also a little more acute. They approach a Spanish form *Var. elliptica,* Frl. M. LEWIN (Spanische Süssw. Alg. p. 9, t. I, f. 16), but are more minutely punctate. It is worthy of note that the arrangement of the granules (or puncta?) in this species is by different authors variously given. In some the arrangement is depicted as being irregular (e. g. KLEBS Desm. Ost. Pr. t. III, f. 50, 51; RALFS Br. Desm. t. XXII, f. I c); in others (e. g. LEWIN, l. c.) the puncta are more or less vertical, and in both views are oppositely ordinate to the angles; this is indistinctly shewn in RALFS (l. c. f. 1 b). DE TONI in his Sylloge p. 1189 classes this species under the section »Semicellulæ granulis *sparsis* ornatæ», it is not *always* so!

Bengal, G. C. W.; East India, from *Utricularia fasciculata,* G. v. L.

6. **S. alternans,** Bréb. (in Ralfs Br. Desm. p. 132, t. XXI, f. 7, 1848; Liste p. 144). Var. **minus,** n. v. Multo minor quam F. typica.

Long. et lat. 15, lat. isth. 9.5 μ. T. XVI, f. 6.

7. **S. ochthodes,** n. sp. S. parvum, rotundum, paullo longius quam latum; semicellulis late ovatis, sub-rotundatis, ordinibus (circ. 12 verticales et 7 transversas) gemmulorum vel granulorum ornatis; sinu profundo, aperto, interne rotundato. A vertice visum triangulare, lateribus paullo incurvatis, angulis rotundatis; granulis radiatim visis.

Long. 20—23, lat. 18—20, lat. isth. 7 μ. T. XVI, f. 22.

8. **S. rotundatum,** n. sp. S. submediocre, quinta parte longius quam latum, clepsydriforme; semicellulæ depresso-ovales, dorso truncato-retusæ; membrana glabra; sinu lato, aperto, interne rotundato. A vertice visum triangulare, angulis late rotundatis, lateribus paullo incurvatis. (Non *Stau.* (*Phycastrum*) *rotundatum* Kütz Sp. Alg. p. 182 = *Pentasterias margaritacea* Ehrb.).

Long. 38, lat. 30, lat. isth. 8 μ. T. XVI, f. 39.

9. **S. microscopicum,** n. sp. S. minutum, tam longum quam latum, semicellulis depresso-ellipticis, dense punctatis (granulatis?) in 3—4 angulos sub-rotundate productis recte vel horizontaliter positis; semicellulæ dorso truncatæ vel leniter convexæ; sinu aperto, fere rotundato. A vertice visum 3—4-angulatum, lateribus valde concavis, angulis acuto-rotundatis.

Long. 14, lat. 14—16, lat. isth. 4.5 μ. T. XIV, f. 23.

This form I have found previously in England (except the 4-angled plant); the Indian and English forms are alike.

10. **S. Dickiei,** Ralfs (Br. Desm. p. 123, t. XXI, f. 3; Lundell Desm. Suec. p. 60). Var. **circulare,** n. v. Frons fere circularis; semicellulæ late flabelliformes non sub-reniformes; sinu triangulari cuneato non sub-lineari; aculeis basi non medio latere positis, rectis, non curvatis ut in f. typica. Membrana glabra.

Long. 24—27, lat. 26-28, lat. isth. 8—9, long. acul. 2 μ. T. XVI, f. 5.

— — f. **major.**

Long. 32, lat. 38, lat. isth. 11, long. acul. 3—4 μ. T. XVI, f. 25.

Very frequent in Bengal.

11. **S. mucronatum,** Ralfs (Annals N. H. vol. XV, p. 152, t. X, f. 5, ex. p., a super. sinistr. et infer. dextr.; Br. Desm. (*S dejectum β* et *γ*) p. 121, t. XX, f. b c; Lundell Desm. Suec. p. 59, No. 13; *Stau. incus* Jacobs ex. p., Desm. Danmk, t. VIII, f. 26 b c, non (Bréb.) Menegh. Synops. p. 228).

β **De baryana,** Nordst. (*St. dejectum* De Bary Conj. p. 87, t. VI, f. 25—32; Jacobs, l. c. supra ex. p. f. 26); Witt. et Nordst. Alg. Exsicc. Fasc. 11, No. 557, as *S. dejectum β Debaryana*).

Cellulæ plus minus incudiformes.

Long. 25—28, lat. 30—33 (sp. incl.) lat. isth. 4—5, l. acul. 5—6 μ. T. XVI, f. 20 (b, a vertice, cellula paullo distorta).

This form differs from those of Ralfs (*β* aculei parallel, and *γ* aculei convergent), in having the broadest part of the semicell apical and not lateral, and in having the

spines so placed. In NORDSTEDT's form (DE BY l. c.) this is so; the Indian specimens having the aculei straight and nearly parallel. Is this the same as *Phyc. convergens* PERTY, Kl. Lebensf., p. 210, t. XVI, f. 34 a?

γ **recta** (RALFS in Annals l. c. t. 5 a super. sinistr.; *St. dejectum var. β* Br. Desm. p. 121, t. XX, f. 5 c). F. **minor** (isthmo elongato).

L. 16—18, lat. 18 (ac. incl.), lat. isth. 3—4; l. spin. 1.5—2.7 μ. T. XIX, f. 15 (forma monstrosa, fide G. C. W. Mscr. No. 267, f. 3.).

The elongate isthmus of these Indian forms is peculiar: in this and in the next it is more noticeable than in the European plants, and might stand as F. **Indica** of both of them.

12. **S. dejectum** (BRÉB. in MENGH. Synops. p. 227, 1840; *St. dejectum α* RALFS Br. Desm. p. 121, t. XX, f. 5 a; *St. mucronatum β* RALFS in Annals N. H. p. 152, t. X a infer. sinistr.; *St. dejectum* LUND. Desm. Suec. p. 59, No. 14).

β **apiculatum** LUND. (l. c. p. 59—60; Stau. apiculatum BRÉB. Liste p. 142, t. I, f. 23). F. **Indica** (isthmo elongato; latitudine minus quam F. Europæa).

Long. c. acul. 22—25, s. acul. 16—19, lat. 13—16, lat. isth. 4—5, long. acul. 3—5; Zygosp. s. acul. diam. 22, l. acul. 8 μ. T. XIX, f. 14 (also in WALLICH Mscr. No. 267, f. 1, 2); Zyg. T. XX, f. 14 (after G. C. W. Mscr. No. 314). BRÉBISSON's *S. apiculatum* seems to be only a small form of his *St. dejectum;* cfr. remarks by LUNDELL, l. c.

γ **connatum,** LUND. (l. c. p. 60, t. III, f. 28 = *St. mucronatum β* RALFS in Annals l. c., t. X, f. 5 a super. dextr.). F. isthmo paullulum elongato.

Long. c. acul. 30, lat. 16—19, lat. isth. 5—6, long. spin. 6—8 μ.

Like β, this is smaller than the European form.

Hab. β. Bengal; γ. Northern India.

13. **S. aristiferum?** RALFS (Br. Desm. p. 123, t. XXI, f. 2). V. **planum,** n. v. Angulis non productis vel mamillatis, apice planum, a vertice visum robustius et crassius quam F. typica; isthmo non elongatum).

Long. 32, lat. 38 (spin. incl.), lat. isth. 7, long. spin. 6—8 μ. T. XVI, f. 32.

This plant seems intermediate between *S. aristiferum* and *S. cuspidatum* BRÉB.; it has the plane apex of the latter, with the shorter isthmus of the former.

14. **S. megacanthum** LUNDELL (Desm. Suec. p. 61, t. IV, f. 1, 1871). Var. expressum, n. v. Minus quam F. typica, depressum; frons s. acul. latitudine magis quam 1½-plo longit.; apicibus fere planis.

Long. 24—28, lat. c. acul. 50—56, lat. isth. 8—9, long. acul. 7—9 μ. T. XVI, f. 29.

In the front view is not so robust as the Swedish plant, but in the vertical aspect it is more so.

15. **S. Kurzianum,** n. sp. S. mediocre, quinta parte latius quam longum; semicellulis ovato-fusiformibus dorso convexis, lateribus tumidis; angulis 3 quoque in processum divergenten paullo recurvatum attenuatum sub-acutum protentis; sinu aperto, cuneato, interne rotundato; membrana glabra. A vertice visum triangulare; lateribus paullo incurvatis, apud angulos paullo inflatis.

Long. 48—52, lat. 60—65 (c. proc.), lat. isth. 12—14, long. proc. 16—17 μ. T. XVI, f. 43, vert. v., f. 34.

This species I dedicate to an oriental botanist and collector DR S. KURZ, whose collections are described in Journ. Asiatic Soc. of Bengal, v. 42, pp. 175—184 (by DRS. ZELLER and RABENHORST), 1873. In general outline it resembles *S. lunatum* RALFS (Br. Desm. p. 124, t. XXXIV, f. 12) but is much larger, with smooth membrane and the terminal processes are outwardly, not inwardly turned.

16. **S. curvirostrum,** n. sp. S. submagnum, circ. duplo latius quam longum (sp. incl.); semicellulis late cuneatis, dorso paullo retusis, ventre paullo inflatis; membrana lævi; sinu aperto, fere rectangulo, interne rotundato; angulis 3, cornubus curvato-recurvatis, modice convergentibus attenuatis acutis, armatis. A vertice visum triangulare, lateribus leniter incurvatis, angulis acuto-rotundatis.

Long. 36—40, lat 75—79 (c. corn.), lat. isth. 10—12, long. corn. 14—17 μ. T. XVII, f. 12 (after WALLICH Mscr No. 262).

F. **compressa.** Angulis binis; a vertice ellipticum, ad angulos acutum.

Crass. 14—18 μ (WALLICH l. c. f. 2).

Raneegunge, Nov. 1855. Rather rare.

17. **S. scolopacinum,** n. sp. S. mediocre, circ. 1½-plo latius quam longum; semicellulæ cuneatæ, dorso fere planæ, apud angulos superioribus paullo contractæ, externe capitatæ; angulis aculeis rectis armatis (quoque angulo rostro et capiti scolopacinis consimile, ex quo nomen); semicellulis ventre paullo inflatis; membrana glabra; sinu valde aperto, obtusangulo, rotundato. A vertice visum triangulare, lateribus medio convexis, apud angulos contractis, angulis capitato-rotundatis.

Long. 34. lat. 53 (c. acul.), lat. isth. 7—9, long. acul. 10 μ. T. XVII, f. 10 after G. C. W. Mscr. No. 273), drawn by WALLICH with a striate mucous investment. The 3 preceding species appeared to be near to *S. leptodermum* LUND., Desm. Suec. p. 58, t. III, f. 26; and *Phycastrum* (*Stau.*) *repandum* PERTY, Kl. Lebensf. p. 210, t. XVI, f. 26; *S. Kurzianum* is the nearest to these, but differs in the cornua being produced and long; the others differ in being decidedly horned or rostrate.

18. **S. unicorne,** n. sp. S. minus, circ. quarta parte latius quam longum (sp. incl.); semicellulæ cuneatæ vel cuneato-trapezicæ, dorso convexæ, ventre plus minus tumidæ; infra angulos (3—4) contractæ, angulis capitatis; quoque capitulo aculeo unico (curvato, recto, convergente, vel divergente) prædito. Membrana glabra; sinu aut brevi rotundato aut obtusangulo amplissimo. A vertice visum 3—4-gonum; in forma quadrangulari lateribus medio fere planis, in forma triangulare plus minus convexis; angulis totis capitato-aculeatis.

Long. 27—30, lat. 35—40 (c. acul.), lat. isth. 6—8, long. spin. 6—10 μ. T. XV, f. 16 (also in WALLICH Mscr. No. 264, f. 1, 3).

A very common form in WALLICH's Bengal gathering.

19. **S. ecorne,** n. sp. S. minus, circ. tam longum quam latum; clepsydriforme; semicellulis cunetatis, dorso convexis, ventre tumidis; infra angulos constrictis et externe capitato-rotundatis (quasi collum et capitem ferentes!); membrana glabra; sinu rotundato; aperto, rectangulo. A vertice visum 3—(4?)-gonum, lateribus medio convexis

externe capitato-rotundatis. Forsan varietas sp. praecedentis, sed in speciminibus nullum aculeum observatum fuit.

Long. 25—30, lat. 27—31, lat. isth. circ. 7 μ. T. XV, f. 17 (also in WALLICH Mscr. No. 264, f. 2).

Like No. 18, very common. NORDSTEDT suggests that this is the preceding species, »in wich the spines had been broken off». I think not; as if so some would have been seen with only 1, 2 or 3 spines — but in nos. 18 and 19 I saw either 3—4 aculei or none!

20. **S. baculiferum**, n. sp. S. submediocre, circ. tam longius quam latius; semicellulis cuneatis, ad angulos protento-mammillatis, dorso convexis, lateribus sinuatis; angulis processubus tenuibus capitatis divergentibus instructis; isthmo elongato, tenui; membrana levi; sinu apertissimo, interne angulato. A vertice visum triangulare, lateribus magis concavis; ad angulos inflatum, angulis acuto-rotundatis.

Long. 30—35, lat. 35, lat. isth. 6, long. spin. 10 μ. T. XIV, f. 25 (after WALLICH Mscr. No. 268).

Raneegunge, Nov. 23, 1855. G. C. W.

21. **S. bifidum** (EHRB.) BRÉB. (in RALFS Br. Desm. p. 215; LUNDELL Desm. Suec. p. 62, t. IV, f. 2; *Desmidium bifidum*, EHR. Abhl. Berl. p. 292, 1832; Infus. p. 141, t. X, f. 11 (in tabulà *D. bidens* pro errore!); *Phycastrum bifidum*, KUTZ. Phyc. Germ. p. 138; *Staur. exsectum*, CLEVE in RABH. Alg. Eur. No. 1925. fide LUNDELL l. c.). Var. **tortum**, n. v. Angulis tortis; spinis non verticaliter nec exacte transverse positis; 3—4-gonum (*S. bifidum* EHR. f. 11, l. c.; Meteorp. t. I, f. 14? non auct.).

Long. 40—44, lat. 54—58, lat. isth. 12 μ; 4-gonum lat. 40 μ. T. XV, f. 8 (c, oblique view); XVI, f. 37, f. tetragonum.

Not uncommon in the Bengal gathering (WALLICH Mscr. No. 240, f. 1, 2). Raneegunge, Oct.—Nov. 1855, G. C. W.

Stau. diptilum NORDST. (Desm. Bras. p. 227, t. IV, f. 56) is so near to the Indian form of this species that it might be called *var. diptilum*. I have a very curious form of this species, from the Himalayas, ex *Utricularia stellari*, communicated by LAGERHEIM; it differs from the type in having the bifid prolongations of the angles incurved and recurved (like horns of oxen) it is of normal size. It might stand as *f. uncinata*.

22. **S. trifidum** NORDST. (Desm. Bras. p. 226, t. IV, f. 51, 1869). Forma **reversa**, n. f. In icone Nordstedtii loc. cit. aculei 1 superior et 2 inferiores positi, sed in *f. reversa* aculei 2, 1. positi sunt.

Long. 38, lat. 52 (incl. sp.), lat. isth. 12, long. spin. 8—9 μ (also in WALLICH Mscr. No. 243).

Raneegunge, rare. Nov. 1855, G. C. W.

The same peculiar reversion of the spines occurs in a related species S. trifurcatum. T. XVII, f. 9, q. v.

23. **S. patens**, n. sp. S. mediocre, paullo latius quam longum, bi-cunetatum; semicellulæ cuneatæ, basi inflatæ; latere sinuatæ, angulis 3 brevibus productis bi-aculeatis; aculeis

rectangulatim positis; apice bi-inciso truncatæ; membrana glabra; sinu brevi, aperto, rotundato. A vertice visum triangulare; apicibus acutis, lateribus leniter concavis.

Long. 60—65, lat. 70 (c. acul.), lat. isth. 16, l. acul. 11—13 μ. (Also in Wallich Mscr. No. 238). T. XIV, f. 21, × 300.

Wallich states that the endochrome is radial, in vertical view bifid towards the angles.

24. **S. ensiferum**, n. sp. S. mediocre, quinta parte latius quam longum; semicellulis cuneatis, ventre inflatis, dorso leniter convexis, angulis 3 brevibus productis bi-aculeatis; aculeis rectis vel paullo curvatis, rectangulatim positis; membrana glabra; sinu brevi, rotundato, vix distincto. A vertice visum triangulare; lateribus fere planis vel paullo concavis, apicibus acutis.

Long. 54, lat. 62 (c. acul.), lat. isth. 11, long. acul. 10—12 μ. Also in Wallich Mscr. No. 240, f. 3). T. XIV, f. 22.

In vert. view scarcely distinguishable in outline form the preceding, but in front view the sides of the semicells, and the apices differ considerably.

Raneegunge, Nov. 1855, G. C. W. Common.

25. **S. quadratum**, n. sp. S. minus, latius quam longum, sub-quadratum; semicellulis late cuneatis, latere inflatis, apice truncato-retusis, externe in angulos 4 productis, angulis bifidis, cornutis, cornubus paullo curvatis, horizontalibus; membrana glabra; sinu acuto-triangulari, interne rotundato. A vertice visum quadrangulare; angulis bifidis, incisuris angulorum interne rotundatis.

Long. 20—25, lat. 25—36 (c. corn.), lat. isth. 15, long. corn. 6.5—8 μ. T. XIV, f. 19, × 300 (after Wallich Mscr. No, 226).

Nearest to *S. bifidum* (No. 21 supra), from which it differs in the general outline of the semicells being more tumid laterally, it is also smaller than that species. Wallich does not notice a triangular form.

26. **S. striolatum** (Näg.) Archer (in P. Inf. p. 740; *Phycastrum* (*Amblyactinium*) *striolatum* Näg. Einz. Alg. p. 126, t. VIII A, f. 3, 1849; forma **Brasiliensis** (*St. striolatum* Nordst. Desm. Bras. 225, t. IV, f. 45).

a. Lat. & long. 28—21; lat. isth. 6 μ. Long. = lat. T. XIII, f. 15.

b. Long. 19—22, lat. 15—18, lat. isth. 6 μ. Longior quam latum. G. C. W.

In the Indian forms (also in Wallich Mscr. Nos. 187, 224) the apices are flat, as represented by Nordstedt l. c., and the fronds often cohere and form short filaments — hence Wallich formed the opinion that this was a »connecting-link between *Staurastrum* and *Sphærozosma*»! Neither Dr W. nor I have seen the triangular form.

27. **S. dilatatum** Ehrb. (Infus. p. 143, t. X, f. 13, 1838; Ralfs, Br. Desm. p. 133, t. XXI, f. 8; Menegh. Synops. p. 227; *Phycastrum dilatatum* Kutz. Phyc. Germ. p. 138; *Goniocystis* (*Staurastrum*) *dilatata*, Hass. Br. Fr. Alg. p. 353, t. 85, f. 5). Var. **Indicum**, n. v. Isthmo elongato, sinu ampliato, angulis non abrupte truncatis, apicibus leniter convexis. Wallich Mscr. No. 278.

Long. 19.5—23, lat. 16.5—20, lat. isth. 7—8 μ. T. XIII, f. 17.

Only the 4-angled form observed by G. C. W.; the one figured by me is 3-angled. This is so much like the preceding that I wonder not at Nordstedt (Desm.

Bras. p. 225) asking »Nonne forma *S. dilatati*? when speaking of the form above, yet I think he placed it correctly. I am not sure that it is a form of the species to which I have referred it.

Bengal; Northern India.

(Nos. 26 and 27 should have followed No. 6, being related thereto.)

28. **S. trifurcatum,** n. sp. S. mediocre, circa quarta parte latius quam longum (sp. incl.), quadrangulare; semicellulis late quadratis, dorso paullo convexis, ventre paullo inflatis: angulis 3, superioribus bifidis, in aculeos duos divergentes protentis, interne rotundatis; angulis inferioribus quoque aculeum singulum acutum attenuatum convergens munitis; membrana glabra; sinu acuto, aperto, interne rotundato. A vertice visum triangulare; lateribus in medio paullo convexis, angulos versus paullo constrictis, angulis externe bifido-aculeatis, interne rotundatis. Massa chlorophyllacea radians, apud angulos bisecta.

Wallich, Mscr. No. 243.

Var. *β* **reversum.** Angulis superioribus simplicibus uni-aculeatis, inferioribus bi-aculeatis bifidis. Wallich, Mscr. No. 242. T. XVII, f. 9 (*β*, after Wallich).

α and *β* long. 35—44, lat. 54—60 (incl. sp.), lat. isth. 13, long. sp. 11 μ.

A 'reversed' form is also found in No. 22 supra.

Raneegunge, Nov. 1855 — rare. G. C. W.

29. **S. Bœrgesenii,** n. sp. St. parvum, sub-circulare, quinta parte latius quam longum; semicellulæ reniformes, dorso convexæ, basi rotundatæ paullo convergentes; semicellulis quinque-lobulatis; membrana glabra?, sinu aperto, sub-æquale, interne rotundato. A vertice visum stellare; lobulis triangularibus, apicibus acuto-rotundatis. Massa chlorophyllacea axili, radiata.

Long. 16—17, lat. 18.5—22, lat. isth. 6 μ. (Also Wallich Mscr. No. 280 B). T. XIII, f. 23 × 300.

To F. Börgesen, a Danish botanist and author, I dedicate this species.

30. **S. fissum,** n. sp. S. minus, quinta parte latius quam longum (proc. incl.); semicellulis cuneatis, ventre inflatis, in 3 angulos superiores bifidos fissis; apice modice convexis; angulis in cornua brevia dua productis, apicibus 2—3-fidis; membrana glabra; sinu brevissimo, rotundato. A vertice visum triangulare, lateribus leniter convexis, angulis sub-acute bifidis.

Long. 13—19, lat. 17—23, lat. isth. 5—7, long. proc. circ. 5 μ. T. XIV, f. 24 (after Wallich Mscr. No. 223).

Elephant Tank, Raneegunge, Nov. 1855, G. C. W.

31. **S. quadricornutum,** Roy & Bisset (Jap. Desm. p. 240, t. 268, f. 4). **Forma.** Cellulis plus minus depressis; minus gracile quam f. typica. Zygospora **globosa,** aculeis longis acutis angustis armata; apud marginem circ. 9 visis.

Long. 24—28, lat. 27—31, lat. isth. 9—10, long. proc. 5—6 μ. T. XIV, f. 2, also Wallich Mscr. No. 221.

f. 2 c. Zygospore (after Wallich l. c.), Diam. s. acul. 31; long. acul. 9—10 μ.

S. gemellipara Nordst. (Desm. Bras. p. 230, t. IV, f. 54) proximum, sed in sciagraphia generali semicellularum differt. F. Wallichiana sistit.

f. **typica** (R. and B., l. c.):

F. 3-gona. Long. 28—30, lat. 24, lat. isth. 5—6, long. proc. 5—6 μ. T. XVI, f. 19 (b is a little oblique).

— — **Forma divergens**; processus breviores, superioribus paullo divergentibus. Long. 30, lat. 25, lat. isth. 8, long. proc. 4—5 μ. T. XVII, f. 4.

F. 4-gona. Long. 27—31, lat. 24—27, lat. isth. 7—8, long. proc. 5—6 μ. Forma lateribus concavis.

All the forms are common in WALLICH's Bengal gathering.

32. **S. contectum**, n. sp. S. mediocre fere longum quam latum; semicellulæ cuneatæ, dorso rotundato-truncatæ angulis superioribus bi-aculeatis bifidis; ventre inflatæ quoque latere medio in processum validum prosilientem rectum apice bifurcatum productæ; membrana glabra: sinu brevi, sub-acuto. A vertice visum 3—4-gonum; lateribus modice concavis, angulis bifidis, aculeis paullo divergentibus, processu paullo contecto.

Long. 38, lat. 42, lat. isth. 8—10, long. acul. 9—10, long. proc. 7—8 μ. T. XV, f. 20.

This peculiar form is not uncommon in DR WALLICH's collection, but does not appear in his Mscr.

Var. **inevolutum.** Fere ut in f. typica sed minor, angulis et processubus minus productis, brevibus. 3- et 4-gonum.

3-gonum long. 19—22. lat. 23—28, lat. isth. 8—9, long. acul. et proc. 3—4 μ.
4-gonum » 24, » 24, » 8, » » » 3—4 μ.
T. XXII, f. 11; XVI, f. 2.

33. **S. trisulcatum**, n. sp. S. submediocre, quinta parte latius quam longum; semicellulæ cuneatæ, apice paullo convexæ, e basi leviter inflatæ ad angulos superiores dilatatæ; angulis trifidis in processubus rectis apice bifurcatis divisis (proc. 2 super. et 1 infer.); parte interiore angulorum bifido rotundato; superficie tota lævi; sinu brevissimo, rotundato-cuneato. A vertice visum triangulare, lateribus concavis, angulis bifidis.

Long. 30—32, lat. 42 (c. proc.); lat. isth. 8—10, long. proc. 9—10 μ. T. XVII, f. 7.

F. **minor.** Fere ut in f. typica sed minor.

Long. 24—28, lat. 30—32, lat. isth. 7—9, long. proc. 8—10 μ. T. XVI, f. 17, figures a little oblique!

Both these forms seem to be not uncommon in Bengal.

34. **S. bisulcatum**, n. sp. S. magnum, circ. 1½-plo latius (c. proc.) quam longius; semicellulis ovatis, dorso convexis apice planis; apice »gemmulis» conicis vel tuberculis circ. 8—9 ornatis; ventre tumidis, lateribus medio inflatis in angulos 3 bicornutis vel bisulcatis productis; cornua elongata, sub-crassa, divergentia, apice acuto rotundata, verticaliter posita, introrsum rotundata; membrana tenui, glabra; sinu breve, valde aperto. Indistincte verticaliter a me visum, sed apparet triangulare cum lateribus paullo concavis.

Long. 80, lat. 115 c. proc.; long. 68, lat. 58 s. proc.; lat. isth. 21, long. proc. 31—34, crass. proc. med. 2—2.5 μ. T. XVI, f. 41.

Near to *S. longispinum* (BAILEY) ARCH. (in Prit. Inf. p. 743, 1861; *Didymocladon? longispinum*, BAIL. Micr. Obs. p, 36, t. I, f. 17; non LUNDELL nec WITTROCK); but it

differs in the apices being elevated not plane, and in the apical tubercles, also in the regularly ovate shape of the semicells. The only *good* figure yet published of *St. longispinum* BAIL. seems to be that of LAGERHEIM (Bidr. Amer. Desm. Fl. p. 249, t. XXVII, f. 28) from which, both in appearance and dimensions, this Desmid differs considerably. I would, however, remark that in American plants the semicells are often more distinctly cuneate, the isthmus being a little narrower, than in the icon of LAGERHEIM. Vide No. 123, seq.

35. **S. papillosum,** KIRCHNER (Alg. Schles. p. 170, 1878; BOLDT Sibir. Chloroph. p 114, t. V, f. 23. *Forma.*

Long. 46, lat. 51, lat. isth. 26 μ. WALLICH Mscr. No. 184.

» 46, » 46, » » 18—23 μ. T. XIII, f. 18.

It is interesting to note yet another Siberian form in India; contrary to the majority of forms this is *larger* than that of the colder climates.

36. **S. cristatum?** (NÄG.) ARCHER (in Prit. Inf. p. 738; *Phycastrum* (Pachyactinium) *cristatum* NÄG. Einz. Alg. p. 127, t. VIII c. f. 1, 1849; *Staurastrum nitidum* ARCHER Dub. Nat. Hist. Rev. t. I, f. 3, 4, 1859). Forma:

Long. 34, lat. 42, lat. isth. 11.5, long. spin. 5—6 μ. T. XVI, f. 44.

This plant seems to be near those figured by NÄGELI and ARCHER, and yet to differ from them in its generally granular angles and scattered spines, it is much like one figure I have seen of *Stau. oligacanthum* BRÉB. (sp. ined.), but yet is unlike the icons of NORDSTEDT (Desm. Arctoæ, t. VIII, f. 39), in which the spines are blunt. I fear that the identity of BRÉBISSON'S species will not be settled until someone perchance is permitted to inspect the original specimens of the author.

Northern India.

37. **S. denticulatum** (NÄG.) ARCHER (in Prit. Inf. p. 738, 1861; *Phycastrum* (*Pachyactinium*) *denticulatum* NÄG. Einz. Alg. p. 128, t. VIII C, f. 3, 1849). **Forma?**

Lat. 41, long. spin. 3 μ. Alia visa non observata. T. XVI, f. 36.

Northern India, J. S.

This seems near to NÄGELI'S form, but is hardly the same — as he represents the sides in vert. v. as denticulate, and in f. v. the angles perfectly striolate.

38. **S. echinatum** BRÉB. (in RALFS Br. Desm. p. 215, t. XXXV, f. 24, 1848; Liste, p. 141, 1856).

Long. 44, lat. 46 (sp. incl.), lat. isth. 11, long. spin. 7—8 μ. T. XVI, f. 48.

Northern India, J. S.; East India, from Utricularia fasciculata, G. v. L.

39. **S. gladiosum?** TURNER (On Desm. p. 938, t. XVI, f. 21, 1885). V. **longispinum.** Spinulis valde elongatis, longitudine irregularibus.

Long. 46, lat. 48, lat. isth. 13, long. spin. 9—17 μ. T. XVII, f. 2 (WALLICH Mscr. No. 180).

In this var. the semicells are ovato-cuneate, not so regularly ovate as in the type, the spines of which are about 6—7 μ long, whilst in the variety they are much longer and vary much in length. As the long. and lat. (c. sp.) are 52 and 60 μ respectively, this may be the *S. sagittiferum* BÖRG. (Desm. Bras. p. 950, t. V, f. 46)?

40. **S. Strensallense,** TURNER, sp. nov. S. mediocre, fere tam longum tam latum; semicellulis depresso-ovatis, dorso leniter convexis, e basi rotundate inflatis; angulis rotundatis; membrana dense aculeata, aculei in series 9—10 transversas dispositi; parte juxta isthmum lævi; sinu acuto, externe aperto. A vertice visum triangulare, lateribus leviter concavis, angulis late rotundatis. Primum ad »Strensall Common», prope Eboracum (York), Anglia, inveni 1883.

Long. 65, lat. 63, lat. isth. 21, long. acul. 3—6 μ. T. XVII, f. 1 x 330.

The spines at the edge of the frond sometimes cross each other, this gives some of them an apparently bifid appearance, which at first deceived me, but after examination showed the aculei to be simple. Only one specimen seen.

Northern India (Sikhim?).

41. **S. sociatum,** WOLLE (Desm. U. S. Amer. p. 142, t. XLV, f. 22, 23). A vertice visum diametro s. sp. circ. 30, long. sp. 4—5 μ.

T. XVII, f. 13. A fronte non observatum.

This agrees fairly well with WOLLE's plant.

42. **S. spinosissimum,** n. sp. S. magnum, fere circulare, quinta usque ad septa parte longius quam latius; semicellulis ovatis, dorso leniter et lateribus late rotundatis; membrana spinosissima; sinu lineari, angusto, extrorsum ampliato. A vertice visum triangulari-rotundatum, non compressum.

Long. 68—81, lat. 56—70 (sp. incl.), lat. isth. 14—16, long. spin. 4—6.5 μ.

T. XIII, f. 7 (after WALLICH Mscr. No. 147).

WALLICH's measure is (circ.) Long. 71, lat. 58 (sin. acul.), long. spin. 4—6.5 μ.

I have seen forms much like it, but hardly so densely spinous, which I have incorporated with my dimensions, but give WALLICH's figure. »Endochrome in large globular masses», G. C. W.

Raneegunge, July 1855. Rare.

43. **S. polytrichum,** (PERTY) LUNDELL (Desm. Suec. p. 63, 1871; *Phycastrum polytrichum* PERTY, Kl. Lebensf. p. 210, t. XVI, f. 24). Forma minor, lateribus semicellularum (a vertice) paullo incurvatis.

Long. 40, lat. 36, lat. isth. 11, long. acul. 3.5—6.5 μ.

T. XIII, f. 16 (after WALLICH Mscr. No. 272).

This is much smaller than the Swedish form (long. 72—78 μ LUND l. c.), but not far from PERTY's dimensions (long. 46 μ).

Raneegunge, Oct. 1855. Rather rare, G. C. W.

44. **S. margaritaceum,** (EHRB.) MENGH. (Synops. Desm. p. 227, 1840; RALFS Annals N. H. vol. XV, p. 157, t. XI, f. 7; *Pentasterias margaritacea* EHR. Infus. p. 144, t. X, f. 15; *Phycastrum margaritaceum*, KTZ. Phyc. Germ. p. 138; *Goniocystis* (*Pentasterias*) *margaritacea* HASS. Br. Fr. Alg. p. 356, t. 85, f. 7), var. **inornatum,** n. v. Vertice visu parte mediana glabra non granulata.

Long. 22.7, lat. 26, lat. isth. 8 μ, G. C. W.

T. XIII, f. 22 (after WALLICH Mscr. No. 217), f. pentagona.

45. **S. stellatum,** REINSCH (In RABH. Alg. Europ. No. 1407, 1862; Spec. Alg. Fung. p. 130, t. XXIII D, f. 2, 1866), var. **pulchellum,** n. v. Processubus 6—7, basi ornatis, quoque

processu prominentiis brevibus emarginatis binis instructo. A vertice visum stellatum, medio corona circulari aculeorum parvorum ornatum.

Long. 32, lat. 38. lat. isth. 13, long. proc. 9 μ: f. hexagona.

T. XIII, f. 24 (also WALLICH Mscr. No. 219, f. 1).

This is much larger than the German and British plants, and in outline combines some of the features of the preceding species. The endochrome is radiate, the number of rays being the same as that of the angles. It is not uncommon in Bengal. [It occurs to me to note that the species named *S. stellatum* by Mr. F. BÖRGESEN, Desm. Bras. p. 953, t. V, f. 53, must be renamed.]

46. **S. coroniferum,** n. sp. S. submediocre, tam longum quam latum; semicellulis fusiformibus, e basi regulariter et valde inflatis, apice verruculis parvis quadrangularibus 6 ornatis, apice truncata; sinu aperto, sub-rectangulo. A vertice visum 6-stellatum, angulis in processus rectos crassos 6 transverse granulato-striatos productis; centrale parte hexagonum, angulis rotundatis. Apicibus processuum truncatis granuliferis vel minute mucronatis.

Long. et lat. 40, lat. isth. 12, long. proc. 11 μ.

T. XIII, f. 21, also in WALLICH Mscr. No. 219, f. 1 a.

This differs from *S. rotula* NORDST. (Desm. Bras. p. 227, t. IV, f. 38) and from *S. coronulatum* WOLLE (Desm. U. S. A. p. 135, t. XLIV, f. 11, 12) in general outline, in size, and in being as broad as long.

47. **S. Willsii,** n. sp. S. submediocre, paullo latius quam longum, superiore parte granulata, apice sub-truncatum vel truncato-rotundatum; semicellulæ late cuneatæ, angulis basalibus rectis; juxta isthmum aculeis brevibus 12 (6 a fronte visis) instructæ; angulis 6 in processus rectos crassos protentis; processubus striato-granulatis, apice truncato-mucronatis, ad basin verrucis binatim positis præditis; sinu brevi, cuneato; membrana in inferiorem partem semicellularum non granulata, lævi. A basi visum angulis interne rotundatis; a vertice centro hexagonum, angulis bi-emarginato-rotundatis, interne verrucis parvis hexagonatim dispositis ornatum.

Long. 38, lat. 40, lat. isth. 12, long. proc. 9 μ. T. XIII, f. 25.

I have seen almost exactly the same form, but rather smaller (23×26 μ) in England, and long ago I wrote upon it to my friend A. W. WILLS, to whom I dedicate this, as *S. margaritaceum forma*. Nearest to *S. odontatum* WOLLE (Desm. U. S. A. p. 134, t. XLIII, f. 8) from which it differs in size and apical arrangement, though agreeing in possession of basal teeth.

48. **S. gemmulatum,** n. sp. S. mediocre, quarta parte latius quam longum; semicellulæ late cuneiformes, processubus rectis crassis granulato-striolatis 6 ad apicem cujusque semicellulæ instructæ; apicibus elevatis, paullo rotundatis vel sub-truncatis, duobus circulis gemmulorum ornatis; centrali parte frondis lævi, margine crenulate sinuato; sinu brevissimo, fere rectangulo. A vertice visum sex-radiatum angulis introrsum late rotundatis; processubus apice rotundatis.

Long. 38, lat. 46—51, lat. isth. 12—14, long proc. 11—18 μ T. XIII, f. 26. Northern India.

The striæ in this plant are very faintly granulate, more approaching minutely rugose.

49. **S. æquum**, n. sp. S. mediocre, sexta parte latius quam longum; semicellulæ late cuneatæ, margine et apice sinuato-crenulatæ; apicibus (et radiis super. lat.) truncato-æquatis; basi rotundato-inflatæ; processubus vel radiis rectis, striate granulatis, apicibus truncate et minute mucronatis; centrali parte frondis glabra; sinu amplissimo, interne subacuto. A basi visum 6-radiatum, centro læve; angulis interne rotundatis.

Long. 35, lat. 42, lat. isth. 12, long. rad. 12—13 μ. T. XIII, f. 26*.

50. **S. pinnatum**, n. sp. S. submediocre, fere tam longum quam latum; semicellulæ cuneato-ovatæ; apicibus (apud basin processuum) 12 pinnatis, pinnis crenato-emarginatis; quaque semicellula cum processubus 6 rectis crassis striato-granulatis apice truncatis minute mucronatis munita; semicellulæ apice truncato-rotundatæ aculeis parvis sparsis, et basi (ad radios) cum aculeis in series duplices verticales, instructæ; lateribus semicellularum sinuatis; sinu brevissimo, sub-acuto, aperto. A basi et a vertice visum 6-radiatum, intra angulos rotundatum.

Long. 38, lat. 42, lat. isth. 12, long. proc. 11 μ.

T. XIII, f. 27, also WALLICH Mscr. No. 218.

Var. **simplex**, n. v. Semicellulæ apice incavatæ, basi non aculeatæ, glabræ; pinnis emarginatis sed simplicioribus.

Long. 36—38, lat. 46—51, lat. isth. 12—14, long. proc. 12 μ. T. XIII, f. 29.

Both these plants are not uncommon in Dr. WALLICH's gathering.

51. **S. torsum**, n. sp. S. minus, quinta parte latius quam longum; semicellulæ cuneatæ, ventre inflatæ, apice paullo rotundatæ corona verruculis parvis 10—12 ornatæ; anguli cum radiis 5 incurvatis ad basalem partem verrucatis apicem versus minute striato-granulatis paullo attenuatis muniti; centrali parte frondis lævi; sinu brevi, cuneato-rotundato. A vertice visum 5-gonum, radiis contortis, angulis rotundate incisis.

Long. 26, lat. 32, lat. isth. 8, long. rad. cum prom. verruc. 11 μ.

T. XIII, f. 28 (also WALLICH Mscr. No. 256 B?).

Bengal, common.

52. **S. ornatum** (BOLDT) NOB. (*S. margaritaceum β ornatum* BOLDT Sibir. Chloroph. p. 115, t. V, f. 27). Paullo major quam plantula Sibirica.

Long. 28, lat. 32, lat. isth. 7, long. proc. 8 μ. T. XIII, f. 28*.

This is very close to BOLDT's form, which (unlike his f. 26!) I hardly think can be classed under *S. margaritaceum*.

53. **S. incisum**, WOLLE (Desm. U. S. A. p. 132, t. XLI, f. 12—14) forma minor. Minor, sed fere ut in f. 12 WOLLEI l. c. delineata.

Long. 12, lat. 16.5, lat. isth. 5 μ (fide WALLICH Mscr. No. 215).

54. **S. foliatum**, n. sp. S. parvum, fere tam longum quam latum, semicellulis (cum. rad.) fusiformibus, e basi inflatis, apice elevato-truncatis, radiis sub-rectis 5 instructis; radii breves striolatæ apice rotundatæ (granulatæ?), quoque radio prominentiis binis conicis basi incluso; centrali parte frondis glabra; sinu aperto, brevi, latiori. A basi visum 5-gonum, radiis paullo recurvatis, cum appendiculis foliaceis.

Long. 20—22, lat. 24, lat. isth. 7, long. rad. c. prom. 5 μ. T. XIII, f. 30.

Note. The above plants Nos. 46—54 form an interesting series, all being evidently related yet differing in material points from one another, and agreeing in other details with those species of which *S. margaritaceum* EHR. and *S. rotula* NORDST. are the extremes.

55. **S. truncatum,** n. sp. S. minus, fere tam longum quam latum; semicellulis ellipticis, basi et apice æqualiter rotundatis, 3-gonis; angulis paullo productis, truncatis, breviter dentatis; semicellulæ apice verrucis (a vertice triangulatim positis) ornatæ, reliqua frondis lævi; margine basis sinuata; sinu brevi, acuto, extrorsum valde ampliato. A vertice 3-gonum, lateribus paullo incavatis, apicibus truncatis.

Long. et lat. 29—30, lat. isth. 10 μ (fide G. C. W.).

T. XIII, f. 20, after WALLICH Mscr. No. 266.

In general outline this agrees fairly well with the variety (*var. β Wolleanum* NOB.) of *S. asperum*, figured by WOLLE (Desm. U. S. A. p. 127, t. XLII, f. 7, 8) which although related to that species, is certainly not the form of BRÉBISSON (*β proboscideum* exclus.). WALLICH distinctly states »frond smooth», all the forms of *S. asperum*, as the name indicates, being rough and granular. This form has the sides crenato-sinuate only, and seems intermediate in form between BRÉBISSON's species *asperum* and *scabrum*.

56. **S. furcatum** (EHRB) BRÉB. (Liste p. 136, 1856; Arch. in Prit. Inf. p. 743; *Xanth. furcatum* EHRB. Abhl. Berl. Akad. p. 318, 1833; Infus. p. 148, t. X, f. 25; Meteorp. p. 12, t. I, f. 21; *Staur. spinosum* BRÉB. in RALFS Br. Desm. p. 143, t. XXII, f. 8; *Phycastrum furcigerum* KTZ Phyc. Germ. p. 138, 1845; *Asteroxanthium furcatum* KTZ. Sp. Alg. p. 183, 1849). Forma **Indica,** n. f.

Long. 23, lat. 18 (s. proc.); long. 30, lat. 28 (c. proc.) lat. isth. 8.5 μ, fide G. C. W. Mscr. No. 222. T. XIV, f. 6.

In this form the processes at the angles are normal in number, but the subsidiary processes are more sub-marginal than dorsal in position; this is seen in the vertical view, in which they appear very short.

Raneegunge, Nov. 1855; G. C. W.

Note. The *Asteroxanthium bisenarium* of KÜTZING (Spec. Alg. p. 183, 1849 (non *Xanth. bisenarium* EHRB., On BAILEY; p. 46 Verbr. Amer.) — Xanth. — No. 3, BAILEY Am. Bacill. p. 291, t. I, f. 16, which is most certainly this species! Referring to EHRENBERG's critical list of BAILEY's forms on p. 46 Verbr. 1843, I find that he refers this to his *Xanth. coronatum*, p. 138, No. 259, t. IV, f. 26, l. c.; which is certainly different from BAILEY's icon, and is really = *St. furcigerum* BRÉB., in Menegh. Synops. p. 216; so that the specific name *coronatum* of EHR. is invalid. This is one of several instances in which EHRENBERG has failed to recognize his own species, or has described the same plant by different names!

57. **S. triangulare,** n. sp. S. parvum, quinta parte longius quam latum; semicellulis cuneatis, apice leniter rotundatis, ventre paullo inflatis; triangulatis, quoque angulo processubus binis sub-verticalibus positis apice bidentatis vel furcatis instructo; membrana tota glabra; sinu amplissimo, fere rectangulo. A vertice visum triangulare, processubus tribus planis tribus elevatis.

Long. 26, lat. 22, lat. isth. 6, long. proc. 4 μ. T. XIII, f. 33.

Central India.

This little form is like a very minute *Stau. furcigerum* BRÉB. (ut supra), but the processes are not attenuate and the frond is quite smooth.

58. **S. paucum,** n. sp. S. submediocre, tam longum quam latum, subcirculare; semicellulis ellipticis, dorso leniter rotundatis, ventre paullo inflatis, triangulatis, quoque angulo processubus 4 rectis divergentibus verticaliter positis (2 supr. 2 infer.) apice tridentiferis munito; membrana glabra; sinu valde aperto introrsum rotundato. A basi visum triangulare, angulis rotundatim fissis, lateribus paullo incavatis.

Long. et lat. 33, lat. isth. 8, long. proc. 7—8 μ (fide G. C. W.). T. XIII, f. 32, after WALLICH Mscr. No. 211.

This seems nearest to the form I have named *S. furcatum f. Indica* (sub. No. 56) from which it differs in the processes being duplex and binate, and deeply tridentate at their apices.

59. **S. Wallichii,** n. sp. S. submediocre, fere tam latum quam longum, egregium; semicellulis quadrangulatis vel indistincte hexagonis, basi inflatis, apice rotundatis; anguli superiores in processus 6 (divergentes) producti; processubus sub-erectis, apice 3—4-fidis; anguli basales cum processubus parvis sessilibus 3—4 dentatis muniti; superficie lævi; sinu aperto, sub-cuneato, interne rotundato. A vertice visum 6-gonum, stellatum; angulis introrsum rotundatis; processubus minoribus non visibilibus.

Long. 40, lat. 38, lat. isth. 10; long. proc. super. 12 infer 1.5—2 μ (fide G. C. W. Mscr. cum icone No. 210). T. XIII, f. 34.

Raneegunge, Nov. 1855. Rare.

To my valued friend G. C. WALLICH I dedicate this micro-plant.

60. **S. sexangulare** (BULNH.) LUND. (Desm. Suec. p. 71, t. IV, f. 9; *Didymocladon sexangularis* BULNH. in Hedw. p. 51, t. IX, A f. 1; *Didymocladon stella* Mask. N. Z. Desm. p. 308, t. XI, f. 9, 10 1880; *Stau. furcato-stellatum* REINSCH Contrib. p. 85, t. XVI, f. 1, 1875). Formæ:

γ. **crassum,** n. v. Cum processubus in ratione dimensionibus crassioribus quam in α (LUND. l. c.): processus aut sinuati et glabri aut serrati.

Long. 60—80, lat. 66—75 (c. proc.), lat. isth. 12—15, long. proc. 16—19, crass. proc. 7—8 μ. T. XV, f. 1, a b for. glabrum; c d forma dentato-serratum.

δ. **intermedium,** n. v. Multo gracilior quam præcedens; processubus paullo attenuatis.

Long 55—60, lat. 60—64 (c. proc.), lat. isth. 10—11, long. proc. 15—16, cr. proc. centr. 4—4.5 μ. T. XV, f. 2, also in WALLICH Mscr. No. 212, 214.

Bengal, G. C. W.; Khasia, G. v. L.

ε. **attenuatum,** n. v. Radiis et processubus tenuibus (*Stau.* (*Didymocladon*) *furcigerum* MASKELL, N. Z. Desm. pp. 246, 254, t. XXIV, f. 13, 1882).

Long. 48—50, lat. 52—57 (c. proc.), lat. isth. 8. long. proc. 14—16, crass. proc. 2 μ. T. XV, f. 3.

All the above forms, as seen by me, are pentagonal.

Formæ Wallichianæ:

1. θ triangularis. 2. ζ compressa (2-angulata).

Formæ parvæ a cl. G. C. WALLICH observatæ, sec. Mscr. No. 216; Proc. et rad. sinuatis et glabris aut serratis.

Long. 42, lat. 43 (c. proc.); long. et lat. (s. proc.) circ 28, lat. isth. 6—7, long. proc. 7—9, crass. proc. 2—3 μ, fide G. C. W. l. c.

The first 3 mentioned above I have found to be exceedingly common in the Bengal matériel. All the apices appear to be simple rotundate, I have not seen one approaching the producto-truncate form of apex mentioned by NORDSTEDT (Alg. N. Z. p. 35, t. IV, f. 1); but it is evident that this is a very polymorphic species. MASKELL'S f. 13 b is hexagonal, a is pentagonal; his f. 10 (of 1880) is heptagonal. Two of WALLICH'S icons show that the lower or basal radii are often much convergent, and cross those of the other semicell, in this case the sides of the semicells appear laterally inclined. JOSHUA, in Burm. Desm. p. 642, enters this species twice, under BULNHEIM'S and REINSCH'S names!

T. XIV, f. 1; a f. θ triangularis; b f. ζ compressa.

61. **S. horridum,** n. sp. S. minus, valde latius quam longum; semicellulæ fusiformes, apice truncato-emarginatæ, basi paullo inflatæ; triangulatæ; intra angulos processubus binis apiculatis vel emarginatis ornatæ; anguli in radios breves producti; radiis valde aculeatis, apicibus 3—4-fidis; semicellularum basis aculeata; juxta isthmum glabra; sinu profundo, acuto. A vertice visum triangulare, lateribus sub-rectis; medio verruculis triangulatim positis ornatum.

Long. 22, lat. 29, lat. isth. 8 μ (after WALLICH Mscr No. 233). T. XIV, f. 4.

Nearest to *Stau. aculeatum* (EHR.) MENGH., from which it differs in the non-aculeate apices and in the brevity of the processes.

62. **S. pisciforme,** n. sp. S. mediocre, circ. quinta pars latius quam longum; semicellulæ longe fusiformes (»pisciformes»), basali parte paullo inflatæ, dorso leniter convexæ; dorsum processubus brevibus furcatis 6 instructum; semicellulæ basi prominentiis sessilibus brevibus emarginatis 6 ornatæ; angulis 3, recte productis, lævibus, apicibus furcatis; membrana glabra; sinu profundo, ampliato, interne rotundato. A vertice visum triangulare, lateribus medio paullo convexis, angulis acutis.

Long. 46—50, lat. 56—62 (c. rad.). lat. isth. 10—14 μ. T. XIV, f. 7, also in WALLICH Mscr. No. 236, 237.

63. **S. Indicum,** n. sp. S. sub-mediocre, 1½—1¾-plo latius quam longum; semicellulæ late cuneatæ, dorso paullo rotundatæ, basi inflato-sinuatæ; dorsum processubus brevibus erectis furcatis 6 instructum; semicellulæ trigonæ, angulis processubus non longis serratis apice dupliciter bifidis (vel 2 et 2 aculeis verticaliter et binatim) munitis; membrana reliqua glabra; sinu brevi, sub-acuto. A vertice visum triangulare, lateribus leniter incurvatis. Massa chlorophyllacea 3-radiata.

T. XIV, f. 11, after WALLICH Mscr. No. 232.

Long. 20, lat. 29 (c. proc.), lat. isth. 6.5 μ.
» 24, » 42 » » » » 9,5 μ.

Raneegunge. 20 Nov. 1885, G. C. W.

The doubly bifid apices of the processes, shewn at f. 11 b, are very peculiar.

64. **S. stellinum**, n. sp. S. magnum, 1¼-plo latius quam longum; semicellulæ late cuneatæ, dorso paullo convexæ, e basi paullo inflatæ; angulis 5 longe productis, processubus divergentibus attenuato-sinuatis apice dilatato-trifidis munitis; membrana glabra; sinu vix inciso, amplissimo. A basi visum 5—6-gonum, stellatum; juxta isthmum cum 5 stigmatibus triplicibus sessilibus ornatum.

Long. 60, lat. 90 (c. proc.), lat. isth. 7, long. proc. 34, long. acul. 5—7 μ. T. XV, f. 6.

Central India.

A peculiar form, apparently between *St. aspinosum* WOLLE (Desm. U. S. A. p. 143, t. LI, f. 22, 23), and *St. platycerum* JOSH. (Burm. Desm. p. 643, t. 24, f. 1. 2). it is smaller and not with spinous or granulate arms, but with basal stigmata.

65. **S. senarium** (EHRB.) RALFS (Br. Desm. p. 216, 1848; *Desmidium senarium* EHR. Verbr. p. 124, t. IV, f. 22, 1843; *Stephanoxanthium senarium* KUTZ. Sp. Alg. p. 184. 1849; *S. furcatum* v. *senarium* auct. nonnull.).

Long. 34, lat. 26 (s. proc.); long. 46, lat. 50 (c. proc.); lat. isth. 11, long. proc. mag. 10—13, long. proc. min. 3—4 μ. T. XV, f. 13.

This form is not uncommon in Bengal, though not noticed by WALLICH in Mscr. It appears to be much smaller than the Swedish plants observed by LUNDELL, Desm. Suec. p. 67, of which it is to be regretted he did not give a figure.

Note. Wilthout entering into the *quæstio vexata* whether *S. senarium* is or is not a var. of *S. furcatum* (EHR.) BREB., the following note by NORDSTEDT is of interest: — Cfr. RABH. Alg. Eur. No. 2325, »*St. furcatum f. trigona;* SANDHEM — O. NORDSTEDT» ... »Inter hoc Staurastrum individua parcissime occurrunt quorum semicellulæ una ad *St. spinosum* RALFS altera ad *St. senarium* EHR. pertinet.»

66. **S. nonanum**, n. sp. S. magnum, paullo longius quam latum (proc. incl.); semicellulis depresso-globulatis, lævibus, dorso et ventre rotundatis; angulis 3—4, quoque cornubus longis crassis rectis lævibus divergentibus 3 apice furcatis vel forcipigeris armato; sinu non profundo, rotundato. A basi et a vertice visum tri-quadrangulare, processubus 9—12 radiantibus, lateribus valde convexis, angulis acuto-rotundatis vel rectangulo-rotundatis.

Long. 38—42, lat. 36—40 (s proc.); long. circ. 80, lat. circ. 74 (c. proc.); lat. isth. 19, long. proc. 18—22 μ. T. XV, f. 14.

f. **minor.** Long. 40, lat. 28 (s. proc.); long. 48, lat. 46 (c. proc.); lat. isth. 13, long. proc. 12 μ.

WALLICH gives: — » 33, » 23 » , » 50, » 53 » ; » 13, long. proc. 14—21 μ, in Mscr. No. 213. T. XV, f. 15.

— **quadrangulare.** Status 4-angulatus formæ præcedentis.

Long. 29, lat. 26, (s. proc.); long. et lat. 50 (c. proc.); lat. isth. 14 long. proc. 10—12 μ. T. XV, f 24; XVI, f. 1.

The forms of this species, except the 4-angled one, are exceedingly common in the Bengal district. It seems nearest to *S. subarmigerum* ROY and BISSET (Jap. Desm. t. 269, f. 2), but differs in the decidedly *convex* sides in vertical view, while the Japanese plant has »sides concave». Mr. ROY in litt. considers this = St. armigerum

BRÉB. (Liste p. 136, t. I, f. 22), but I believe that BRÉB.'s plant = *St. eustephanum* EHR. (*Desmidium eustephanum* EHR. Verbr. p. 124, t. IV, f. 23, 1843), both of which are granulate, with serrate arms and margin, while this is quite smooth, besides differing in other details.

67. **S. subarmigerum,** ROY et BISSET (Jap. Desm. p. 239, t. 269, f. 2, 1886) forma.

Long. 22, lat. 21 (s. proc.), long. 28, lat. 32 (c. proc.), lat. isth. 8—10, long. proc. 4—5 μ. WALLICH, in Mscr. No. 220, gives long. et lat. (s. proc.) 31, lat. isth. 8.7, long. proc. 8—9 μ. T. XIII, f. 31.

In this peculiar plant the processes are the exact reverse of those in *St. furcatum*, being 2 superior and 1 inferior at each angle, and divergent. From the above dimensions it appears that the forms noted by WALLICH were larger than those I have seen, and also the Japanese plants of R. and B. Could it not be considered as a *reversed* variety of *St. furcatum?*

68. **S. arcuatum,** NORDST. (Norg. Desm. p. 36, t. I, f. 18, 1873).

Long. 20—24, lat. 28—32 (s. proc.); lat. isth. 7—9 μ, fide G. C. W. Mscr No. 244. T. XIV, f. 20, after WALLICH l. c.

There seems to be but little difference between the Norwegian and Indian forms, except that the dorsal processes in the latter are a little longer and in vert. v. are more divergent.

69. **S. Hantzschii** REINSCH (Spec. Alg. Fung. p. 129, t. XXII D f. 4, 6, 1, 1866; *St. intricatum* DELP. ex parte (Desm. Sub. Alp. p. 139, t. XI, f. 10, 14, 15, 20; excl. f. 11? 12, 13, 16, 18, 21; 1877) — var. **cornutum,** n. v.

Long. 24, lat. 20 (s. proc.); long. et lat. 30 (c proc.); lat. isth. 9, long. proc. 6—7 μ.

This variety, though smaller in size, differs but little from REINSCH's form except in the length of the processes. It is nearly equal in dimensions to the Italian plant of Delponte. T. XV, f. 23.

70. **S. infestum,** n. sp. S. parvum, fere tam longum quam latum; semicellulis cuneatis, dorso convexis, ventre paullo inflatis; angulis tribus rotundate fissis, in processus rectos binos divergentes productis; dorso apud angulos processubus 3 sub-erectis brevibus munito; processubus omnibus apice furcatis; superficie tota lævi; sinu brevi, sub-acuto. A vertice visum triangulare, lateribus paullo convexis, processubus ad angulos radiatim dispositis.

Long. 17, lat. 13 (s. proc,); long. 22, lat. 19 (c. proc.); lat. isth. 5, long. proc. dors. 2, long. proc. ang. 4—5 μ. T. XV, f. 21.

71. **S. Roysii,** n. sp. S. minus, fere tam latum quam longum; semicellulis cuneatis, dorso convexis, ventre paullo inflatis; angulis 3—4, late rotundate fissis, in processus rectos binos divergentes productis; dorso supra angulos processubus (æquali longitudine cum inferioribus) sub-erectis 3—4 munito; processus omnes furcati; membrana glabra; sinu brevissimo, rotundato. A vertice visum 3—4-angulare, lateribus paullo convexis; processubus (1 super. et 2 infer.) ad angulos productis radiantibus.

Long. 22, lat. 18 (s. proc.); long. 32, lat. 30 (c. proc.); lat. isth. 8. long. proc. 7—8 μ. T. XV, f. 25.

I dedicate this distinct little species to a good micro-observer, and my valued friend, Dr. JOHN ROY, of Aberdeen.

72. **S. ineditum**, n. sp. S. mediocre; fere tam longum quam latum (incl. proc.); semicellulae fusiformes, dorso convexae, e basi regulariter expansae; angulis 8 in processus rectos singulos productis, angulos versus processubus brevioribus 3 dispositis (1 dorsali et 2 ventralibus); processus omnes apice furcati; membrana laevi; sinu aperto, brevi, rotundato. A vertice visum triangulare, lateribus convexis, versus apices attenuatis.

Long. 36, lat. 28 (s. proc.); long. et lat. 48 (c. proc.); lat. isth. 11; long. proc. ang. 10—11, long. proc. caet. 6—7 *μ*. T. XV, f. 27.

This is probably the same as the form included by DELPONTE under his species *St. intricatum* (Desm. sub. alp. t. XI, f. 16, 21, caet. excl.), in which certainly 8 diverse forms are described.

73. **S. Japonicum** (R. & B.) nob. (*St. Hantzschii var. β Japonicum* ROY and BISSET, Jap. Desm. p. 240, t. 269, f. 5). S. mediocre, quarta vel quinta parte longius quam latum (proc. incl.); semicellulis a fronte visis perfecte globosis, dorso radiis 5—7 sub-longis rectis fere erectis apice bifidis instructis; ventre radiis 8—10 longioribus rectis fere horizontalibus apice bifidis munitis; semicellulis glabris non sub-lobatis ut in *St. intricato* DELP., nec cuneato-fusiformibus ut in *St. Hantzschio* REINSCH; radiis laevibus non margine serratis vel dentatis; sinu aperto, rotundato, in visu basali circulo granulorum suturam circum ambiente. A vertice visum 8—10-radiatum, angulis interne rotundatis.

Long. 37—40, lat. 18—21 (s. proc.); long. 46—50, lat. 33—40 (c. rad.), lat. isth. 10—12, long. rad. 10—13 *μ*. T. XVI, f. 24.

The number of rays in this form varies considerably; taking the vertical ones first and the horizontal ones in succession, I have noted forms thus, 5—8 one specimen. figured; 5—9, figured; 6—9 R. et B. l. c.; 6—10; 5—10. It appears to be nearly related to *St leptacanthum* NORDST. (Desm. Bras. p. 230, t. IV, f. 46), but differs much therefrom in being smaller and with considerably shorter arms, which are not so widely expanded at the furcate apices.

74. **St. Bissetii**, n. sp. S. minus, fere tam longum quam latum; semicellulis cuneatis, dorso late et ventre paullo rotundatis, triangulatis; quoque angulo processubus brevibus rectis laevibus apice furcatis 7 (3 et 3 utroque latere verticalibus, et 1 centrali) armato; membrana glabra; sinu aperto, rotundato. A vertice visum triangulare, lateribus paullo incurvatis, processubus radiantibus divergentibus.

Long. 26, lat. 18 (s. proc.); long. 30, lat. 32 (c. proc.); lat. isth. 8, long. proc. 5—7 *μ*. T. XVI, f. 26.

To my kindly correspondent J. P. BISSET, of Banchory, (coadjutor of Mr. ROY in micro-botany,) I dedicate this distinct form.

75. **S. rusticum**, n. sp. S. minus, quinta parte latius quam longum; semicellulis irregulariter cuneatis, dorso convexis, ventre inflatis, laevibus; angulis 3, in processus paullo convergentes, minute aculeatos, apice 3—4 dentatos, productis; quoque angulo processubus brevibus 2 erectis bifidis, cum aculeo brevi crasso unico inter verrucas 2, ornato; parte centrali frondis laevi; sinu brevi, acuto. A vertice visum triangulare, lateribus in centrali parte fere rectis apice acutis.

Long. 24, lat. 30 (c. proc.), lat. isth. 7, long. proc. 7—8 μ. T. XVI, f. 27.

76. **S. Zelleri**, n. sp. S. submediocre, fere tam longum quam latum, semicellulis a fronte globosis, processubus 5—6 lateralibus horizontalibus lævibus rectis apice furcatis munitis, et æque numero processuum dorsalium consimilium verticalibus, et supra inferriores dispositis, instructis; membrana glabra; sinu brevi, rotundato. A vertice visum 5—6-gonum, stellatum; angulis introrsum rotundatis; processubus superioribus a inferioribus subtentis.

Long. 28—30, lat. 29—33, lat. isth. 7—9, long. proc. 6—7 μ. T. XVI, f. 28.

I have given this specific name in remembrance of Dr. G. Zeller, who, in 1873, wrote upon Indian Fresh-water Algæ.

77. **S. Renardii** Reinsch (Sp. Alg. fung. p. 127, t. XXIII A, f. 1, 1866; *Didymidium* (*Staurastrum*) *Renardii*, Reinsch Alg. Frank. p. 168, t. VII, f. 9, 1867; *Stau. truncatulum* Reinsch Contrib., p. 91, t. IX, f. 3, 1875).

Long. 25, lat. 22 (c. proc.), lat. isth. 7, long. proc. 3—4 μ. T. XVII, f. 3; a is shewn slightly oblique.

This seems not uncommon in Bengal. Refering to the last synonym, the change of name by its own author without apparent cause is hardly commendable. Nordstedt (Alg. N. Z. p. 36, t. IV, f. 2) very properly retains the old name.

78. **S. pseudofurcigerum** Reinsch (Alg. Frank. p. 169, t. XI, f. 2, 1867; Sp. Alg. fung. p. 128, t. XXIII, C f. 1, 1866; Wolle, Desm. U. S. A. p. 147, t. LII, f. 27, 28, 1884; Cooke Br. Desm. p. 147, t. LXI, f. 4, 1887; *Stau. furcatum c pseudofurcigerum*, Rabh., Fl. Eur. Alg. III, p. 218, 1868; non Lundell (Desm. Suec. p. 71. nec Cooke J. Q. Club, p. 208, t. 14, f. 1—3, 1880). *Forma.*

Lat. 36, proc. apic. longit. 6 μ. T. XVII. f. 5.

I overlooked this form when making my sketch No. 667, so only drew it in vert. view, but think I am correct in thus referring it. The species of Ehrb. *St. eustephanum* has frequently been mistaken for this species, though Reinsch (in mem. cit. pp. 169 and 128) says distinctly »membrana glabra». The principal processes, at the angles, are shorter than in *furcatum* and *senarium*.

79. **S. saltans**, Joshua Burm. Desm. p. 641, t. 23, f. 21, 1886).

Long. 43—47, lat. 65—80, lat. isth. 10—12, long. proc. 17—24 μ. T. XIV, f. 8, (b corpore in capsulà incluso).

At b a curious state is depicted (after Wallich Mscr. No. 261, f. 4); Dr. W. says, »The arms appeared protruding from a distinct membranous elliptical cell — the upper spines being . . . reflected upwards, so as to meet each other at the inner side of the top of the cell, . . ., these spines are no completely developed». The form is 2-angled, and near to *S. grallatorium β forcipigerum* Lagerh. (Amer. Desmti. p. 249, t. 27, f. 27), and to the type-form. *S. grallatorium* Nordst., q. v. No. 88.

80. **S. galeatum**, n. sp. S. mediocre; $1^{1}/_{2}$—$1^{3}/_{4}$-plo latius quam longum; semicellulæ cuneatæ, dorso elevato-rotundata spinulis singulis crassis capitato-acutis horizontalibus utroque latere ornato (spinulis nonnullis aliter cuneato-acutis), ut »galeam» ferentes; ventre paullo inflatæ; angulis 3, longe productis, processubus convergentibus, margine serrato-dentatis apice inæqualiter furcatis, quoque angulo ad marginem superiorem basis

processu (vel aculeo erecto crasso, vel processu erecto emarginato) instructo; centrali parte frondis laevi; sinu brevi, rotundato. A vertice visum triangulare, lateribus paullo convexis.

T. XIV, f. 3, 9, 10 (9 after WALLICH Mscr. No. 259, 261, f. 3).

These forms are frequently »compressed» or 2-angled, f. 9 is so; 9 a is an example of incomplete cell-division; WALLICH (from whom I copied them) thinks b is »an aborted cell» — may it not be the very commencement of division? Dimensions:

Long. 46, lat. 76, lat. isth. 10, long. proc. 26 (c. acul.) μ.
» 41, » 58, » 9, » » 17 » »
» 45, » 69, » 9, » » 21 » »
» 38, » 60, » 9, » » 19 » »

Fairly common in Bengal, G. C. W., 1855; East India, from *Utricularia fasciculata*, G. VON L., 1889.

81. **S. orientale,** n. sp. S. mediocre, quinta parte latius quam longum; semicellulis cuneatis, dorso elevato-rotundatis utroque latere apicis spinulis singulis crassis transverse divergentes munitis; ventre paullo inflato; angulis 2, processubus crassis paullo convergentibus, margine inferiore sinuatis, superiore aculeis 3—4 validis elongatis erectis armatis, apice 1—3 spinulis vel prominentiis munitis; membrana reliqua glabra; sinu brevi, rotundato. A vertice visum 2-gonum, compressum, semicellulis c. proc. angusto-fusiformibus.

Long. 50, lat. 64 (c. proc.), lat. isth. 14; long. proc. 16, crass. semic. 18—21 μ. T. XIX, f. 5 (after WALLICH Mscr. No. 259).

There seems to be a small form of this, with dimensions:

Long. 33, lat. 48, lat. isth. 10, long. proc. 10 μ. = **f. minor.**

WALLICH says »Constriction marked by a band», but I do not notice this in his icons.

82. **S. leptocladum** NORDST. (Desm. Bras. p. 218, t. IV, f. 57) var. **cornutum,** WILLE (Bidr. Sydamer. Alg. flor. p. 19, t. I, f. 39). T. XIV, f. 12 (after WALLICH Mscr. No. 252, 253, 255) × 330.

Long. 45—50, lat. 90—98, lat. isth. 8—9, long. proc. 33, crass. semic. 17 μ.

These dimensions are from his drawings, but he must have seen a smaller form, long. 30, lat. 58,5 μ! **(f. minor).**

T. XIV, f. 16 (from Central India) × 500.

Long. 46, lat. 96, lat. isth. 9, long. proc. 32 μ.

Neither WALLICH nor I have seen the typical form.

83. **S. grallatorium,** NORDST. (Desm. Bras. p. 228, t. IV. f. 52).

Long. 40, lat. 96, lat. isth. 8, long. proc. 32, crass. 16 μ. T. XIV. f. 15.

Central India.

Exactly like the Brazilian form, but a little larger

84. **S. pseudosebaldi** WILLE (Norg. Fersk.-alg. p. 45, t. II, f. 30) β **bicorne** BOLDT (Sibir. Chloroph. p. 117, t. VI, f. 36).

Forma cum centrali parte apicis non inciso-aspera.

Long. 45, **lat.** 65, **lat. isth.** 9, **crass** 15 μ. T. XIV, f. 14 × 330, after WALLICH Mscr. 251 B.

Baboosole, 22 Oct. 1855, G. C. W.

γ **pulchellum,** n. v. Apice productum, truncato-crenatum, apud angulos tricornutum, cornubus brevibus crassis acutis vel emarginatis; basi inflatum, inflatione summa mucronata.

Long. 42—50, lat. 70—75, lat. isth. 15 μ. T. XVI, f. 14.

α **typica,** WILLE l. c., long. 50, lat. 57 μ, ex *Utricularia stellari*, from the Himalayas, G. VON L.

85. **S. Bengalense,** n. sp. S. submagnum, plus 1½-plo latius quam longum, compressum; semicellulis cuneatis, dorso leniter convexis, ventre inflatis; in angulis 2 longe productis; processubus convergentibus, margine serrato-dentatis apice trifidis; dorso et apice semicellularum seriebus 3 verrucarum transverse ordinatis, a vertice visibilibus; semicellulæ in basali parte utroque latere 4 vel 8 prominentiis brevibus emarginatis verticaliter (2, 2) positis ornatæ; membrana reliqua lævi; sinu brevi, cuneato-rotundato, externe ampliato. A vertice visum longe fusiforme.

Long. 53, **lat.** 87, **lat. isth.** 11, **long. proc.** 25, **crass.** 18 μ.

Forma minor; long. 31, lat. 46 μ. T. XIV, f. 13 × 300 (also in WALLICH Mscr. No. 251 A.).

86. **S. Sunderbundense,** n. sp. S. mediocre, circ. 5-ta parte longius quam latius; semicellulæ cuneatæ dorso verrucis emarginatis præditæ, ventre sinuatæ; in processus 3 angulis productæ, processubus crassis verrucose striato-dentatis paullo convergentibus apice 3-aculeatis; centrali parte frondis lævi: sinu brevi, rotundato. A vertice visum triangulare, centro coronâ verrucarum ornatum, processubus apud bases seriebus 2 verrucarum vel dentium instructis; a basi visum centro paullo rugatum non dentatum. *Stau. pseudosebaldo* WILLE, Norg. Desm. p. 45, t. II, f. 32 proximum?

Zygospora globosa, spinis longis rectis attenuatis basi conicis apice bi-furcatis (vel 4-ramosis) margine 7 visibilibus ornata.

Long. 40, lat. 42—47, lat. isth. 10, Zygospora dimetro 25, long. spin. 16—17 μ. T. XIV, f. 18 × 400; Zygospore, etc. after WALLICH Mscr. No. 228.

87. **S. Sonthalianum,** n. sp. S. mediocre, circ. 1½-plo latius quam longum, bicornutum vel 3-angulare; semicellulæ late triangulares, dorso et ventre convexo-emarginatæ; centrali parte frondis lævi; processubus margine inferiore rugosis, superiore basi emarginato-verrucatis apice dentatis finibus furcatis; sinu brevi, acuto. Processus leniter convergentes. A latere visum 2—3-gonum; f. 2-gona fusiformi apice verrucis in series duas, et f. 3-gona lateribus incavatis apice verrucis triangulatim positis (centro lævi), supra processus æque verrucosum, ornata. Zygospora ovalis, spinis longis rectis attenuatis, basi conicis, apice 4-ramosis, apud marginem circ. 9 visis, armata.

Long. 40—48, lat. 53—69, lat. isth. 10; Diam. zygosp. 35 × 45, long. spin. 22 μ. T. XIV, f. 27 × 400 (also in WALLICH Mscr. No. 227, 230, 231; zygosp. after WALLICH No. 229).

The 2-angled form in vert. v. is much like *S. bicorne* HAUPTFL. (Zellmemb. Desm. p. 37, t. III, f. 24), but that is punctate and the verrucæ do not extend *in*

series upon the arms; the front v. entirely differs in the basal portion. The 3 angled form seems nearest to, but smaller than, *S. Sebaldi β Brasiliense* BÖRGESEN (Desm. Bras. p. 952, t. V, f. 51); it is also near to the next, than which it is much smaller and more depressed.

88. **S. proboscideum** (BRÉB.) ARCH. (in RALFS Br. Desm. p. 139, as *S. asperum β proboscideum*, t. XXIII, f. 12 b. c. non a; *S. proboscideum* ARCH. in Prit. Inf. p. 742, 1861), *β* **altum** BOLDT (Sibir. Chloroph. p. ?17, t. VI, f. 34, 1885).

Long. 75—80. lat. 66—70, lat. isth. 17—19 μ. T. XVI, f. 46; XXI, f. 6.

I think this is quite distinct from *S. asperum;* both that species and this one are omitted from BRÉBISSON'S 'Liste', 1856!

Northern India.

89. **S. paradoxum** MEYEN (Einige nied. Algform. p. 777, t. 43, f. 37, 38, 1828! *Micrasterias staurastrum* KÜTZ. Synops. p. 599, 1833; *Phycastrum paradoxum* KÜTZ. Phyc. Germ. p. 138, 1845; *Goniocystis* (*Staurastrum*) *paradoxum* HASS. Br. Fr. Alg. p. 354, t. 85, f. 3, 1845).

α **Forma** 2—3-gona.

Long. 35—40, lat. 50—55, lat. isth. 4, crass. 7, long. proc. 10—13 μ.

β **longipes** NORDST. (Norg. Desm. p. 35, t. I, f. 17).

Long 50—60, lat. 75, lat. isth. 7, crass. 12, long. proc. 16—18 μ.

Zygospora globosa, glabra, colore fusco-brunnea — diametro 12 μ. T. XV, f. 4, *α*, a b d e; *β*, c f. (a b f c after WALLICH Mscr. No. 234).

α. This seems a rather larger form than that of RALFS, Br. Desm. p. 138; *β*. compared with the Norwegian form of NORDSTEDT l. c. is much more depressed, less stout in the body, but of equal expanse of arm.

γ **depressum,** n. v. Processubus fere parallelis.

Long. 20, lat. 28, lat. isth. 4 μ. T. XV, f. 5.

90. **S. hexacerum** (EHRB.) WITTROCK (Gotl. Öl. Sötv. Alg. p, 51, 1872; *Desmidium hexaceros* EHRB. Beitr. Erk. Organ. p. 293, 1834; Infus. p. 141, t. X, f. 10, excl. f. f., cfr WITTR.! *Binatella tricornis*, BRÉB. Alg. Fal. p. 57, t. VIII, 1835! *Staurastrum tricorne*, MENGH. Synops. p. 225, 1840; RALFS Br. Desm. t. XXII, f. 11, XXXIV, f. 8, 1848).

Long. 21, lat. 27, lat. isth. 5.5 μ.

In Meteorp. p. 12, t. I, f. 11, 1839, EHRENBERG named this form *Desmidium hexaceros*, ut supra; in Verbr. Amer. 1843, p. 46, he re-names the form (fig. 2, 3 in BAILEY'S list) as *D. tridens*, and in the same work p. 159 he styles it *D.* (*tridens*) *hexaceros*, a singular caprice! Cfr note sub No. 56.

91. **S. subrotula,** n. sp. S. mediocre, sexta parte latius quam longum; radiis 5—6 præditum; semicellulis ovato-cuneatis, dorso convexis coronâ verrucarum parvarum instructis, ventre sinuatis; radiis rectis convergentibus rugatis dentibus minutis præditis, apice 3—4-fidis; centrali parte frondis lævi; sinu brevissimo, sub-acuto. A vertice visum 5—6-gonum, stellatum; centro corona circulari verrucarum ornatum; angulis interne rotundatis.

Long. 34, lat. 36, lat. isth. 10 μ. T. XV, f. 7.

92. **S. ordinatum,** n. sp. S. mediocre, circ. $1^1/_2$-plo latius quam longum; semicellulæ triangulares, dorso truncatæ processubus paullo elevatis et latis emarginatis 2 (6 a vertice visis) ornatæ, ventre bi-sinuatæ, suturâ aculeis 12 (6 super. 6 infer. binatim angulis suppositis) divergentibus instructæ; radii 3 paullo inflexi margine inferiore et lateribus dentibus minutis 3-seriatim ordinatis præditi, apice 3-aculeati; margine superiore basi processubus 4 conico-acutis, 2 a fronte visis, margine reliqua dentata; centrali parte frondis glabra; sinu parvo, rotundato. A vertice visum triangulare; lateribus centro vel rectis vel paullo incurvatis.

Long. 31, lat. 48, lat. isth. 7 μ. T. XV, f. 9.

93. **St. lacerstum,** n. sp. S. mediocre, paullo latius quam longum; semicellulis cuneatis, dorso sub-truncatis paullo productis verrucis late emarginatis 9, 3 a fronte visibilibus, ornatis; ventre inflatis aculeis parvis sparsis instructis; angulis 3 processubus convergentibus curvatis basi super. parte 1—2 cornutis superficie dentatis apice 2—3-fidis productis; apud bases processuum, in parte dorsali, prominentiis 3 erectis capitatis tridentiferis armatis; sinu brevi, rotundato. A vertice visum triangulare, lateribus centro fere rectis vel paullo incurvatis angulos versus paullo inflatis.

Long. 50—56, lat. 52—65, lat. isth. 9—12 μ. T. XV, f. 11, (also in Wallich Mscr. No. 260).

94. **S. resupinum,** n. sp. S. mediocre, circ. $1^1/_3$-plo latius quam longum; semicellulis triangularibus, dorso truncato-rugatis vel crenatis granulis vel stigmatibus circ. 12 et paullo sub-dorsum prominentiis brevibus emarginatis 6 (2 a fronte visis) instructis; ventre tumidis, crenato-sinuatis; angulis in 3 processus cornutos divergentes striate dentatos apice trifidos productis; ad suturam aculeis parvis 12, 2 et 2 geminatis divergentibus ornatis; sinu brevi, rotundato. A vertice visum triangulare, lateribus modice concavis angulis rotundatis.

Long. 36, lat. 46, lat. isth. 9 μ. T. XV, f. 12.

95. **S. sp.** T. XV, f. 22.

Long. 14, lat. 17 (proc. incl.), lat. isth. 6 μ.

This little plant I am dubious of placing, it seems intermediate between *S. contortum var. β pseudotetracerum* Nordst. (N. Z. Alg p. 37, t. IV. f. 9) and *St. inconspicuum* of the same author (Norg. Desm. p. 26, t. I, f. 11, 1873, = *S. minutissimum* Auersw. in Rabh. Alg. Eur. No. 1428 saltem ex p., sec. Nordst.; et = *S. subrefractum* Lem. Desm. Vosges. p. 23, t. I, f. 3, 1883). It is minutely granular, with 3—4 minute teeth at the truncate apices of the radii which are not expanded as in *S. contortum* Delp. (Desm. Sub. Alp. p. 152, t. XI, f. 53—55). Nordstedt's N. Z. form appears hardly to be *S. contortum var.*

96. **S. Wittrockii,** n. sp. S. mediocre, sexta parte latius quam longum; semicellulis fusiformibus, dorso convexis, ventre paullo inflatis; angulis 3—4 in radios productis; radiis rectis attenuatis margine crenatis superficie striate dentatis divergentibus apice 3—4-fidis; membrana sinuosa in centrali parte frondis non punctata nec granulata; sinu, sub-acuto, aperto. A vertice visum 3—4-gonum, centrali parte lævi; lateribus in centrali parte (in 3-gonum) planis vel leniter concavis, (in 4-gonum) angulis interne planis vel latissime rotundatis.

Long. 40, lat. 47, lat. isth. 10, long. proc. circ. 14 μ. T. XV, f. 26.

To Professor V. B. Wittrock, of Upsala, I take the liberty of dedicating this species, in token of the benefit I have derived from the perusal of his researches, and as a trifling acknowledgment of his kind interest concerning this memoir.

97. **S. uncinatum**, n. sp. S. submediocre, circ. quinta parte latius quam longum; semicellulis late cuneatis, dorso truncatis, crenatis, processubus 6 uncinatis (2 inter quemque angulum) ornatis, ventre inflatis, marginibus semic. plus minus crenato sinuatis; angulis 2—3, in cornua rugosa productis, paullo divergentibus, apicibus furcatis vel forcipatis; centrali parte frondis lævi; sinu brevi rotundato. A vertice visum 2—3-gonum; 2-gonum fusiforme, 3-gonum triangulare, lateribus paullo convexis.

Long. 37, lat. 46, lat. isth: 9, crass. 2-gonum 13 μ. T. XVI, f. 3, also in Wallich Mscr. No. 67 ex. p.

Near to S. *scorpioideum* Delp. (Desm. sub. alp. p. 155, t. XII, f. 42—45) but differs in the dorsal spine being decidedly hooked. (Query-are not Delp's long. & lat. *reversed* in the measurement given? Cfr his f. 42).

98. **S. Nathorstii**, n. sp. S. submagnum, fere 1½-plo latius quam longum; semicellulis cuneatis, dorso truncatis, (a fronte) 6—7-crenatis crenæ latere unigranuliferæ, prominentiis magnis erectis emarginato-apiculatis tribus (quoque processu inter aculeos duos crassos et post tergum aculeum breviorem etiam crassum) apud angulos ornatis; ventre basi inflatis supra 3-sinuatis, inflatione basali summatim 3—6 mucronibus parvis prædita; angulis 3, processubus validis rectis horizontalibus serrato-dentatis apicibus trifidis armatis; sinu aperto, cuneato, brevi. A vertice visum triangulare, lateribus concavis; centro verrucis conicis triangulatim positis ornatum.

Long. 46—58, lat. 60—72, lat. isth. 12—14. long. proc. dorsal. 5—6 μ. T. XVI, f. 8.

Name in honour of Dr. A. G. Nathorst, a distinguished Swedish botanist. This plant appears to me to be quite distinct, yet bearing considerable resemblance to its congeners S. *sebaldi β ornatum* Nordst. (Norges Desm. p. 34, t. I, f. 15) and S. *pseudosebaldi*, Wille, l. c. ut supra, from which it differs in the spines, and in the elevated and crenate dorsal region.

99. **S. apiculiferum**, n. sp. S. submagnum, quinta parte latius quam longum; semicellulæ cuneatæ, dorso truncatæ verrucoso-pinnatæ emarginatæ; angulos versus prominentiis magnis 3 erectis truncatis apice spinulam unicam ferentibus ornatæ; ventre tumidæ, tumoribus variis extensis quarumque formâ valde differt (i. e. rotundata, angulata, plus minus apiculata — breviter dicta, »ventre polymorphæ»); angulis 3, radiis crassis rectis horizontalibus serrate striato-dentatis apice 3—4 aculeatis productis; sinu brevi, aperto. A vertice visum triangulare, lateribus incavatis; dorsali parte medio lævi, marginem versus pinnis triangulatim dispositis.

Long. 55—63, lat. 70—75, lat. isth. 12—15, long. proc. dors. 5—7 μ. T. XVI, f. 7.

F. minor. Long. 33—40, lat. 44—49, lat. isth. 10—12, long. proc. dors. 3—4 μ, see Wallich Mscr. No. 258 f. 2, 4; 235.

Searsole; G. C. W.

100. S. **Manfeldtii,** Delp. (Desm. Sub-Alp. p. 160, t. XIII, f. 6—19, 1877) β **bispinatum.** Apud angulos spinis vel pinnis truncato-emarginatis binis munitum.

Long. 48—50, lat. 58—64, lat. isth. 13—14 μ. T. XVI, f. 11—12.

Ad. fig. Delpontii 13 (semic. infer.) accedens.

γ **pinnatum.** Dorso inflatum, serie prominentiis pinnato-emarginatis circ. 7 ornatum.

Long. 50, lat. 60, lat. isth. 10 μ. T. XVI, f. 10.

Fig. 11 f. Delpontii proximum.

The latter is so different from the other forms figured by the Italian author that it might reasonably claim to rank as a species.

101. S. **Burmense,** Nob. (*S. bifurcum* Joshua Burm. Desm. p. 642, ex. p., t. XXIII, f. 27).

Long. 40—50, lat. 51—60, lat. isth. 8—9 μ.

In Mr. Joshua's figures 3 distinct species seem to be included; 25, 26 are one form (the type?); 28 is anomalous, the semicells being of diverse shapes, quite different from each other! However, this latter may possibly be a recurrence of the fact observed by Nordstedt, in *S. senarium*. T. XVI, f. 13.

102. S. **bellum,** n. sp. S. submediocre, paullo latius quam longum; semicellulis irregulariter cuneatis; dorso productis truncatis minute crenatis; apud angulos prominentiis tridentatis vel pinnato-emarginatis binatim dispositis (quaque prominentia inter aculeos conicos duos posita) ornatis; ventre incavatis, basali parte inflatis; angulis in processus curvatos convergentes striato-dentatos apice 3—4 spinuliferos productis; centrali parte frondis lævi; sinu brevi rotundato. A vertice visum 3-angulatum, lateribus concavis; medio crenis triangulatim positis ornatum.

Long. 36—39, lat. 40—45, lat. isth. 7—9, proc. long. circ. 12 μ. T. XVI, f. 9 *

103. S. **curvatum,** n. sp. S. submediocre, fere tam longum quam latum; semicellulæ irregulariter cuneatæ, dorso rotundato-pinnatæ, pinnis 6—7 brevibus apice acuto-incisis; ventre incavatæ parte superiore acuto-inflatæ basi rotundato-inflatæ sub angulis 3 mucronatæ; angulis in processus productis, quoque processu convergenti curvato attenuato minute striato-dentato apice trifido; membrana reliqua lævi; sinu brevissimo, rotundato. A vertice visum triangulare; lateribus concavis; centrali parte glabrum.

Long. 46—55, lat. 48—54, lat. isth. 8 μ. T. XVI, f. 9.

104. S. **recurvatum,** n. sp. S. minus, fere tam longum quam latum; semicellulis fusiformibus, dorso verrucatis, ventre paullo tumidis, angulis 3 in radiis brevibus divergentibus paullo recurvatis minute striato-dentatis apice truncatis 3—4 dentatis productis; centrali parte frondis lævi; sinu brevissimo, rotundato. A vertice visum triangulare, lateribus incurvatis, in partem dorsalem verrucis triangulatim positis.

Long. 20—26, lat. 26—28, lat. isth. 6, long. rad. 6—8 μ. T. XVI, f. 16.

Bengal, G. C. W.; East India, from *Utricularia fasciculata*, G. v. L.

105. S. **ambiguum,** n. sp. S. parvum, quarta parte longius quam latum; semicellulis late cuneatis, dorso elevato-truncatis minute crenatis granulatis (granulis in lineas submarginales ordinatis); ventre tumidis; angulis 3—4, cum radiis rectis attenuatis fere parallelis brevibus minute dentatis apice 3—4-fidis armatis; membrana reliqua glabra;

sinu brevi rotundato. A vertice visum 3—4-gonum; centrali parte elevata, 3—4-gona, angulis rotundata.

Long. 18—20, lat. 22—25, lat. isth. 6—7, long. rad, 7 μ. T. XVI, f. 18.

106. S. festivum, n. sp. S. minus, circ. $1^{1}/_{2}$-plo latius quam longum; semicellulis cuneatis; dorso truncatis crenatis utroque latere prominentiis pinnato-emarginatis parvis 3 marginalibus ornatis; ventre basi rotunde inflatis circulo mucronibus minutis munitis, supra sub-acute constrictis; sinu brevissimo, rotundato; angulis 3 in radios parallelos rectos paullo attenuatos minute dentatos apice 3—4-fidos productis. A basi visum triangulare, lateribus concavis, marginibus quasi ut in *S. vestito* RALFS ornatis. *S. proboscideo* (BRÉB.) ARCH. *f. Javanica* NORDST. (Alg. NORD. p. 11, t. I, f. 19) propius — nonne forma alia?

Long. 20, lat. 32, lat. isth. 6, long. proc. 8.5 μ. T. XVI, f. 31.

I think that the Javanese form of NORDST. l. c. and this one might *possibly* be united as *S. Javanicum?*

107. S. trachydermum, n. sp. S. parvum, fere tam longum quam latum; semicellulis late cuneatis, dorso sinuato-undatis, ventre plus minus sinuatis paullo inflatis; angulis in processum breve attenuatum scabrum dentatum apice truncatum 3—4 mucronatum productis; in parte juxta isthmum frons lævis est; sinu brevissimo, aperto. A vertice visum triangulare, lateribus medio leviter concavis, margine scabris.

Long. 26—30, lat. 28—34, lat. isth. 7—9 μ. T. XVI, f. 23.

F. minor; dorso valde sinuatum.

Long. et lat. 23, lat. isth. 6 μ. T. XVI, f. 47.

108. S. opimum, n. sp. S. submediocre, fere tam longum quam latum; semicellulæ cuneatæ, dorso emarginato-pinnatæ truncatæ, ventre sinuatæ glabræ; angulis 3 in radios extensis; radiis crassis rectis brevibus attenuatis fere parallelis margine sinuatis valde striate dentatis apice truncatis 3—4 mucronatis; sinu brevissimo, cuneato. A vertice visum triangulare, lateribus vel planis vel paullo incavatis, medio pinnis triangulatim dispositis ornatum.

Long. 33, lat. 35, lat. isth. 9 μ. T. XVI, f. 35.

109. S. mutabile, n. sp. S. parvum, quinta parte latius quam longum; semicellulis late cuneatis, dorso truncatis aculeatis, ventre inflatis sinuatis; centrali parte frondis lævi; angulis 5—7 in radios paralleles vel paullo convergentes productis; sinu brevi, rotundato. Radii recti, striate dentati attenuati apice truncati 3—4 mucronati. A vertice visum stellatum, 5—7-gonum, angulis interne rotundatis, medio aculeis parvis (2 quumque angulum appositis) circulatim ordinatis instructum.

Long. 28, lat. 34, lat. isth. 8.5, long. proc. 8—9 μ. T. XVI, f. 42 (a is slightly oblique).

110. S. conicum, n. sp. S. sub-mediocre, octa parte longius quam latum, semicellulis reverso-triangularibus, dorso sub-acute conicis, dorsum versus leniter incurvatis; ventre expansis basi valde latis; semicellulæ indistincte 3-lobulatæ; angulis 2—3 convergentibus conicis aculeis parvis singulis instructis, finibus basaliter positis; membrana glabra; sinu profundo, acuto, extrorsum parum constricto. A vertice visum 2—3-

gonum; forma 2-gona elliptica apicibus acutis; f. 3-gona triangulari lateribus medio leniter concavis apicem versus paullo inflatis, apice acute rotundatis.

Long. 28—30, lat. 24—26, lat. isth. 6 μ. T. XVI, f. 38 (also in WALLICH Mscr. No. 183).

111. **S. ignotum**, n. sp. A basi visum ovale lateribus medio paullo compressis, apicibus semicircularibus. Semicellula (ut mihi visa est) processubus parvis brevibus (3—3.5 μ longis) tubuliformibus apice furcatis basi incrassatis in series transversales ordinatis ornata; apud suturam prominentiis minutis emarginatis sparsis munita.

Lat. 30, crass. 19, lat. isth. 8.5 μ. T. XVI, f. 30.

It is very unusual to describe a form from a basal or vertical view only, but as this form is so peculiar I have made it an exception. In this I follow the example of the great EHRENBERG; cfr. his t. IV, f. 21—23 in Verbr. Amer. 1843.

112. **S. brevispinum** BRÉB. (in MENGH. Synops. nomen solum! p. 229, 1840; in RALFS Br. Desm. p. 124, t. XXXIV, f. 7, 1848). Forma, semicellulis altioribus quam in forma typica; BOLDT (Sibir. Chloroph. p. 113, t. V, f. 30, 1885) = f. **Boldtii**, NOB., n. f.

Long. 38—40, lat. 34—37, lat. isth. 18—22 μ. T. XVI, f. 45.

This agrees very closely, though a little broader, with the Siberian form of BOLDT.

113. **S. angulare**, n. sp. S. submediocre; circ. tam longum quam latum; semicellulis late hexagonis, dorso fere planis, lateribus uni- et fere rect-angulatis; angulis externis 4 acuto-mucronatis, quoque angulo mucronibus 4 munito; membrana glabra; sinu aperto, fere rectangulo. A vertice visum octagonum, ut 4-gonum cum angulis cæsis; lateribus et angulis paullo incavatis, angulis 8 mucronatis. *S. quadrangulari* BRÉB. proximum.

Long. 30, lat. 28, lat. isth. 13 μ. T. XIV, f. 17.

This is rather larger than *S. quadrangulare* BRÉB. (in RALFS Br. Desm. t. XXII, f. 7; t. XXXIV, f. 11), and differs therefrom in the sides being angled and not vertical.

114. **S. nodiferum**, n. sp. S. submediocre, circ. $1^{1}/_{2}$-plo latius quam longum; semicellulis irregulariter pentagonis, dorso convexis, ventre angulato-inflatis (sub angulis aculeos parvos 3 gerentibus); angulis tribus paullo constrictis et externe paullo divergentibus nodulatis vel rotunde capitatis, quoque capitulo cum 3—4 aculeis acutis curvatis brevibus ornato; membrana glabra; sinu apertissimo, cuneato-rotundato. A vertice visum triangulare, lateribus convexis, apicibus capitatis, sub-apicibus paullo constrictis.

Long. 33, lat. 30—37, lat. isth. 7 μ. T. XIV, f. 26 (also in WALLICH Mscr. No. 241).

Raneegunge, 23 Nov. 1855; G. C. W.

Cfr. also No. 116.

115. **S. unguiferum**, n. sp. S. mediocre, fere duplo longius quam latum; semicellulis cuneato-quadraticis; dorso fissis trilobatis, lobis triangulatis apicibus aculeis parvis erectis instructis; lateribus vel rotundato-expansis vel fere planis; membrana lævi; sinu plus minus aperto rotundato. A vertice visum triangulare, angulis late rotundatis, lateribus paullo incurvatis.

Long. 42—52, lat. 24—28, lat. isth. 14, long. acul. 2—2.5 μ. T. XV, f. 18 (also in Wallich Mscr. No. 265, f. 1).

Forma **major.** Majus, elongatum, paullulum constrictum sinu nullo; aculeis paullo convergentibus.

Long. c. acul. 72—76, lat. 33—35, lat. isth. 20—22, long. acul. 5—6 μ. T. XV, f. 19.

Cfr No. 117.

116. **S. eximium,** n. sp. S. mediocre, quinta parte latius quam longum; semicellulis subfusiformibus, dorso leniter convexis, ventre e basi regulariter inflatis; angulis 3 paullo contractis externe rotundate capitatis; capitulis 4—5 mucronatis, mucronibus oppositis; semicellulæ sub angulis prominentiis plus minus brevibus trifidis instructæ; et apud suturam prominentiis minoribus etiam trifidis ornatæ; membrana reliqua glabra; sinu valde aperto rotundato. A vertice visum triangulare, centrali parte convexum; angulis capitatis et apices versus constrictum.

Long. 42, lat. 52, lat. isth. 11.5, long. mucr. 1.5 μ. T. XVII, f. 6 (after Wallich Mscr. No. 239).

This species is decidedly unique, but nearest to *S. nodiferum*, No. 114.

117. **S. inerme,** n. sp. S. submediocre; circ. $1^{1}/_{2}$-plo longius quam latum; semicellulis incurvo-cuneatis, dorso incavatis, latere inflato-curvatis; semicellulæ trilobatæ, lobis erectis attenuatis triangularibus latere curvatis apice acuto-rotundatis inermibus; medio frondis modice constrictum; sinu nullo vel indistincto. A vertice visum triangulare, lateribus incurvatis, angulis sub-acute rotundatis. *S unguifero* No. 115 propius.

Long. 42, lat. 26, lat. isth. 17 μ. T. XVII, f. 8 (also in Wallich Mscr. No. 265, f. 3).

This is much like the plant No. 115 without spines, but beyond this difference the apices of the lobes are rounder and not so acute. Probably nearest to S. corniculatum Lundell (Desm. Suec. p. 57, t. III, f. 23) from which it differs mostly in being sub-lobate.

118. **S. Lundellii,** n. sp. S. mediocre, paullo latius quam longum; semicellulis trapezicis, dorso rotundatis, ventre irregulariter tumidis externe expansis; sinu brevi acuto; centrali parte frondis lævi. Angulis 3—4, radiis brevis rectis paullo attenuatis fere horizontalibus superficie striato-rugosis apice truncato-rotundatis productis. A vertice visum 3—4-gonum; centrali parte rotunde 3—4-gona glabra.

Long. 36—45, lat. 42—46 c. rad.; lat. isth. 12, long. rad. circ. 7 μ. T. XVI, f. 15.

To the author of the »De Desmidiaceis . . . Suec.» I dedicate this little member of a family upon which he has so well written. (To the chance perusal of Dr. Lundell's memoir, in which the excellence of the descriptions is but equalled by the elegance of the Latin, I owe my commencement of Desmid-study. W. B. T.).

119. **S. Maskellii,** n. sp. S. mediocre, quarta parte longius quam latum, modice constrictum; semicellulis cuneato-trapezicis, dorso leniter convexis, ventre expando-tumidis; sinu nullo; membrana dense et minute granulata. Semicellulæ trilobatæ, angulis in lobis attenuatis vel brachiis crassis sub-erectis divergentibus apice paullo incurvis pro-

ductis. A vertice visum triangulare, lateribus convexis vel concavis alternantibus, angulis controversis.

Long. 41—44, lat. 31—35, lat. isth. 12—14 μ. T. XVI, f. 21.

To this species I give the name of my friendly correspondent Mr. W. M. Maskell of Christchurch, N. Z.

120. **S. iotanum,** Wolle (Desm. U. S. A., p. 137, t. LI, f. 5—7, 1884) f. **pentagona,** n. f.

Long. 18, lat. (c. proc.) 20, lat. isth. 5, long. proc. 5—6 μ. T. XXII, f. 12.

Northern India.

121. **S. ceratodes,** n. sp. S. minus, tam longum quam latum, quadraticum; semicellulæ sub-quadratæ, lateribus et apice modice convexæ; angulis inferioribus unicornutis, angulis superioribus bifidis, et introrsum spina curvata sub-erecta munitis; spinis vel cornubus processu conica apud basin instructis; cornubus apicalibus recte basalibus convergentibus dispositis; membrana glabra?; sinu cuneato, interne rotundato. A vertice visum 4-angulare; angulis bifidis patentibus, cornua divergentibus, spinâ unicâ transcendente. Massa chlorophyllacea radiata, angulos versus bifida.

Long. et lat. (corn. incl.) 16—19, lat. isth. 5—7 μ. T. XIV, f. 28 a b (after Wallich Mscr. No. 225).

122. **S. Sebaldi** Reinsch (In Act. Senck. vol. VI, p. 133, t. XXIV, D 1, 1866) var. β *ornatum* Nordst. (Norg. Desm. p. 34, f. 15, 1873).

Long. 72, lat. 81 μ.

A small minor form, but perfect in outline.

East Bengal, from *Utricularia flexuosa*, comm. G. von L.

123. **S. longispinum** (Bail.) Archer (in Prit. Inf. p. 743, 1861; cfr synon. sub No. 34).

Long. cell. 92, lat. 67, long. spin. 44 μ.

A peculiarity of the Indian form was that the spines were perfectly straight, though normally divergent; one specimen only seen.

Himalayas, from *Utricularia stellaris*, comm. G. von L.

T. XXIII, f. 12.

Cfr remarks sub No. 34.

The genus Staurastrum, being very polymorphic, requires a considerable number of sub-genera to deal with its forms.

A. **Schizastrum** (*σχίζω*, scindo; *σατρον*, stella)........................ Formæ Furcatæ.
Typ. sp. St. longispinum, bidentatum, bifidum, forficulatum, Brasiliense.

B. **Trochastrum** (*τροχος*, rota; &c.).. » Rotiformes.
Typ. sp. St. rotula, margaritaceum, coronulatum.

C. **Hoplastrum** (*ὅπλα*, arma; &c.).. » Armatæ.
Typ. sp. St. arctiscon, leptacanthum, sexangulare.

D. **Cyptastrum** (*κυπτόω*) arcuo; &c.).. » Arcuatæ.
Typ. sp. St. arachne, cerastes.

E. **Cephalastrum** (*κεφαλὶς*, capitulum; &c.).. » Capituliferæ.
Typ. sp. St. bacillare, globulatum.

F. **Hectastrum** (*ἔκτασις,* extensio; &c.) .... Formæ Sub-productæ.
Typ. sp. St. leptodermum, corniculatum.
G. **Cylindriastrum** (*κύλινδϱος,* cylindrus; &c.) .... » Cylindriformes.
Typ. sp. St. amœnum, Meriani, pileolatum.
H. **Glyptastrum** (*γλυπτος,* sculptilis; &c.) .... » Sculptiles.
Typ. sp. St. crenatum, Maamense.
I. **Brachiastrum** (*βϱαχιων,* brachium; &c.) .... » Brachiatæ.
Typ. sp. St. leptocladum, grallatorium.
J. **Rutidiastrum** (*ϱυτίδοω,* corrugo; &c.) .... » Rugosæ.
Typ. sp. St. spongiosum, rhabdophorum.
K. **Raphidiastrum** (*ϱαφὶς,* acus; &c.) .... » Aciculiferæ.
Typ. sp. St. echinatum, teliferum, geminatum.
L. **Acanthastrum** (*ακανθα,* spina; &c.) .... » Unispinuliferæ.
Typ. sp. St. aristiferum, dejectum, megacanthum.
M. **Sphærichastrum** (*σφαιϱικος,* globosus; &c.) .... » {Non-productæ, plus minus globosæ.
Typ. sp. St. orbiculare, rugulosum, lanceolatum, pachyrhynchum.
N. **Odontastrum** (*ὀδοντωτος,* dentatus; &c.) .... » Dentatæ.
Typ. sp. St. aculeatum, megalonotum, controversum.

Gen. 20. **Arthrodesmus**, Ehrb.

(Infus. p. 149, 1838, mut. char.; Ralfs, char. emend. Br. Desm. p. 117, 1848; Archer in Prit. Infus. p. 736, 1861).

1. **A. subulatus,** Kütz. (Spec. Alg. p. 176, 1849; *Euastrum* No. 12, Bailey Amer. Bacill. p. 296, t. I, f. 12, 1841; *Arthrodesmus quadricaudatus* ex part. Ehrb. Verbr. Amer. p. 46, 1843). Formæ:

b. **forma media** = fig. cit. Bail. (cfr Nordst. Desm. Bras. p. 232).

Long. 32, lat. s. ac. 37, c. acul. 63; lat. isth. 8, long. acul. 13—14 μ; semicellulis basi magis inflatis. T. XI, f. 37 (A. incus v. Americanus Turner Micr. J. p. 937, t. XVI, f. 17).

Long. 26, lat. s. ac. 30, c. ac. 62; lat. isth. 8, long. acul. 16 μ. T. XI, f. 36.
» 32, » » 30, » 63; » 7, » » 16.5 μ. T. XII, f. 4.

c. **forma minor.** Kütz. l. c. (*Arth. convergens d subulatus* Rabh. Fl. Eur. Alg. III, p. 227; Nordst. l. c.).

Long. 18, l. s. ac. 20, c. ac. 39; lat. isth. 5, crass. 7.5, l. acul. 9.5 μ. T. XI, f. 39.

Hab. b. Bengal, common; c. Northern India.

2. **A. incurvus,** n. sp.? A. minor, fere circularis; sino acuto, sub-cuneato; membrana lævi; semicellulis ovatis, e sinu rotundatis, angulis basalibus acuto-rotundatis spinula singula parva convergente posita instructis. A vertice visus ellipticus.

Long. 27, lat. s. acul. 26, c. ac. 30; lat. isth. 12, crass. 14, long. ac. 2 μ.

Nonne *Staurastrum Dickiei* Ralfs forma 2-gona? T. XI, f. 28.

3. **A. minor,** n. sp. A parvus, bi-ovalis; sinu profundo acuto externe valde ampliato; membrana glabra; semicellulis ovalibus utroque latere media spinula brevi acuta horizontaliter posita munitis. A vertice visum ovalis apicibus paullo acuto-rotundatis.

Long. 21, lat. s. sp. 20, c. sp. 24, lat. isth. 5, crass. 10, l. sp. 2 μ. T. XI, f. 29.

4. **A. crispus,** n. sp. A. major, sub-quadraticus; semicellulis cuneatis, dorso truncatis vel leniter incurvatis, e basi superne inflatis; valde cornutis; cornubus angulis superioribus positis, crassis attenuatis incurvo-recurvatis apice sub-acutis; sinu brevi rotundato; membrana glabra. A basi visus compresso-ovalis, lateribus fere planis.

Long. 48. lat. s. corn. 44—46, c. corn. 90—94; lat. isth. 15; crass. 22; long. corn. 22—26 μ. T. XI, f. 30.

5. **A. hiatus,** n. sp. A. mediocris, late ovalis, magis constrictus, sinu cuneato-triangulari valde aperto; semicellulis dolabriformibus externe rotundatis e basi divergentibus margine rectis vel paullo sinuatis; membrana glabra. Angulis lateralibus aculeis brevis acutis rectis 4 instructis, deorsum positis. A vertice visum ellipticus apicibus subacutis. Formæ:

f. **major.**

Long. 37, lat. s. ac. 44—46, c. ac. 50—56; lat. isth. 8—9; long. acul. 3—6 μ. T. XI, f. 40; XII, f. 1, c. semic. juv.

f. **minor.**

Long. 28, lat. s. ac. 32, c. ac. 36; lat. isth. 10, long. ac. 1.7—2 μ. T. XI, f. 34.' Is it possible that f. 28 is a rotund and compressed form of this?

6. **A. convergens,** Ehr. (Inf. p. 152, t. X, f. 18, 1838; Hassall Br. Fr. Alg. p. 357, t. 85, f. 9; *Staurastrum convergens* Menegh. Synops. p. 228; Ralfs in Annals N. H. v. XV, p. 158, t. XII, f. 1; *Euastrum convergens*, Kütz. Phyc. Germ. p. 136). Formæ:

α **typica.**

Long. 38—48, lat. s. acul. 40—44, c. acul. 50—64, lat. isth. 13—15, crass. 21—23, l. ac. 6—12 μ. Zygospora ovalis, membrana crassa glabra, diam. 54 × 44 μ, G. C. W. 1855! T. XII, f. 3, sec. G. C. W.; XI, f. 42.

Bengal, G. C. W.; East Bengal, ex Utricularia flexuosa, G. von L.

β **curta.** F. curta, compacta, spinulis brevioribus.

Long. 35—42, lat. s. ac. 34—40, c. ac. 48—53; lat. isth. 13, crass. 20—21; long. ac. 4—5 μ. T. XI, f. 32 (a after G. C. W. Mscr. No. 172).

γ **minor.**

Long. 33, lat. sin. ac. 36, c. ac. 54; lat. isth. 9, crass. 16, long. spin. 9 μ. T. XI, f. 41.

The Zygospore of this species, first figured by Cleve (in Lundell Desm. Suec. t. III, f. 22], was noted by Wallich in India, 1855. In t. XI, f. 32 a, is a facsimile from Wallich showing the »swarming of the granules», he says the chlorophyll-mass »shrunk up to about $^{1}/_{3}$ of its original bulk, occupying the centre of segment, whilst the motile granules vere collected into 2 cells (intra-cellular spaces) one on each side of the endochrome. They are at this stage evidently contained in distinct capsules, two in each segment; the endochrome (in the centre) having its distinct envelope». This

observation of Wallich is very interesting as to the possible existence of »swarm capsules», each with a membranous investment. I have often seen the phenomenon myself, but the granules always appeared to me to be *free* within the semicell.

[Semic. cum parasita (endophyte?). T. XII, f. 12, after G. C. W. Mscr. No. 171. Wallich says that when thus attacked the endochrome collapses as at a; »a number of vibratile granules (b) of a brownish colour being retained between it and the end of the segment. From the other extremity of the endochrome-membrane arises a tube, which expands in diameter until it reaches the cell-wall, and it then contracts into a narrow neck (c), passes through the wall, and finally again expands . . . and extends outwards. Have observed this phenomenon in many species.» G. C. W. Might not this be a formation *analogous* to that in Archer's observation on Zoospores in Desm. (N. H. Soc. Trans. Dubl. t. I, f. 1—4, 1860)? My own opinion being that what Archer saw were really the tubes of an Endophyte, and not due to a Desmidian effort to produce zoospores! Probably something allied to *Olpidium* Al. Braun. Cfr Braun, *Über Chytridium*, &c., 1855; idem, Alg. Unicell. 1855; Cienkowsky, *Kennt. de Monaden*, 1865; Cornu, Bull. Soc. Bot. de France, T. XIX, 1872; Sorokine, *Ueb. Wasserpilze*, Bot. Zeit. 1874; idem, *Siphomycètes*, Bull. S. Nat. de Kazan, 1874; idem, *Chytridiacées*, 1883; Reinsch, *Ueb. Saprolegnien, Parasiten*, t. XVII, f. 11—12, 1885; also Boldt, *Sibir. Chloroph.* t. V, f. 18, in which *X. antilopæum*, with a similar parasite, is depicted; and Archer in Dubl. Club. Proc. in Q. I. Mic. Sci. p. 199, 1869].

7. **A. curvatus**, n. sp. A mediocris, habitu *A. convergenti* consimilis, sed semicellulis subcuneatis non ovalibus; aculeis longioribus et validioribus quam in specie comparata, curvo-recurvatis (non convergentibus) horizontaliter positis, et sinu latiore valde aperto, differt. A vertice visus elongato- vel compresso-ellipticus. Zygospora sphærica, lævi.

a. Forma **typica**. Long. 34—40, lat. s. acul. 34—40, c. acul. 51—60; lat. isth. 10—13, crass. 15—17, long. acul. 13—18 μ. T. XI, f. 33, XII, f. 2 (also Wallich Mscr. 173 A.).

Zygospore diam. 29 μ, T. XII, f. 11, after Wallich, No. 179.

b. Forma **major**. Major, semicellulis cuneatis, cornubus longis crassis.

Long. 44, lat. s. acul. 42, c. ac. 84, lat. isth 12, crass. 19, long. acul. 22 μ. T. XI, f. 35; XII, f. 8.

Very frequent in Wallich's Bengal collection of 1855.

[T. XII, f. 7, represents ordinary vegetative cell-division; f. 13 × 550 represents a Desmidian curiosity. G. C. W. says, »the two *new and smaller* segments placed *externally* to the old ones.» I need not quote my friend further, as I think his view is erroneons, my own idea being that two *new and larger* segments (in fact »forma major»!) were developing *from two old semicells* of normal size — this theory may possibly account for the appearance of large forms, not at all different except in size. T. XII, f. 15 × 550 represents »two recently separated fronds exhibiting the sustaining and still uninterrupted cell-membrane» (mucous investment). G. C. W. sub. No. 178. Mscr. These 3 figures are after Wallich.]

8. **A. Indicus**, n. sp. A. sub-magnus, s. ac. fere tam longus quam latus; semicellulis triangularibus vel late cuneatis, dorso paullo rotundatis vel leniter incurvatis, basi parum

inflatis superne valde dilatatis; aculeis magnis leniter convergentibus apicem versus recurvatis; membrana glabra; sinu parvo sub-acuto vel vix distincto. A basi visus acute ellipticus.

Long. 39, lat. s. acul. 36, c. acul. 76, lat. isth. 9—10, crass. 15, long. acul. 20 μ. T. XII, f. 10.

b. Forma **minor.** Fere ut supra sed minor, apud suturam parva incisura instructa.

Long. 23, lat. s. ac. 28, c. acul. 36, lat. isth. 5—6, long. acul. 13 μ. Fide G. C. W. Mscr. No. 173 B.

9. **A. Gangensis,** n. sp. A. magnus, depressus, s. acul. quinta parte latius quam longus, sub-quadraticus; semicellulis late cuneatis, basi valde contractis superne multo inflatis; dorso truncatis sæpe leniter incurvatis angulis rotundatis; aculeis convergentibus apice recurvatis non longis crassis instructis; membrana glabra? sinu valde aperto, cuneato interne rotundato. A vertice visus longe ellipticus apice acutus vel lanceolatus.

Long. circ. 51, lat. s. ac. 60—62, c. acul. 90—94, lat. isth. 15—16, crass 23, l. acul. 15—16 μ. T. XII, f. 14; XI, f. 38.

These two species (8 and 9) form connecting-links between the ovate forms, as *A. convergens*, and the distinctly triangular ones, as *A. triangularis*, LAGERH.

10. **A. incus** (BREB.) HASS. (Br. Fr. Alg. p. 357, t. 85, f. 10, 1845; RALFS Br. Desm. p. 118, t. XX, f. 4; *Cosmarium incus*, BREB. fide MENGH.; *Staurastrum incus*, MENGH. Synops. p. 228, 1840; RALFS in Annals vol. XV, p. 158, t. XII, f. 2; *Euastrum retusum*, KÜTZ. Phyc. Germ. p. 135, sec. RALFS; *Staurastrum pseudincus*, REINSCH Spec. Alg. Fung. p. 123, t. XXIV, C II 1866?). Formæ:

a. Forma RALFS f. 4 b.

Long. 24, lat. s. ac. 16, c. acul. 28, lat. isth. 6, long. acul. 6 μ. Fig. nostr. 6 a.

b. Forma RALFS, f. 4 g.

Long. 24, lat. s. ac. 20, c. acul. 38, lat. isth. 7, long. acul. 9 μ. Fig. nostr. 6 b.

c. Forma, REINSCH l. c., f. 3, accedente, sed paullo major. »Forma Reinschii» NOB.

Long. 15, lat. s. ac. 20, c. ac. 34, lat. isth. 8, long. acul. 7 μ. Fig. nostr. 6 c. T. XII, f. 6.

All from Northern India.

11. **A. spicatus,** n. sp. A submediocris; magis latior quam longus, ovalis; semicellulis ellipticis, apice et e basi æqualiter convexis, lateribus in processus curvatos paullo convergentes acutos productis; membrana glabra; sinu pyriformi, interne acuto rotundato. A latere visus biglobatus; a vertice visus acuto-ellipticus. Corpora amylacea bina in quaque semicellula.

Long. 30, lat. c. proc. 35—40, lat. isth. 10, crass. 16, long. proc. 5 μ, sec. G. C, W. T. XIX, f. 12 × 400, after WALLICH Mscr. No. 177.

12. **A. phimus,** n. sp. A. minor; semicellulis cuneatis, dorso incurvatis, latere e basi inflatis medio paullo convexis, angulis superioribus protentis acutis aculeis parvis munitis; membrana glabra; incisura mediana rectangula interne rotundata. In habitu generali phimiformis, ex quo nomen specificum. A latere visus angusto-ovalis centro paullo incavatus.

Long. 26, lat. s. acul. 20, lat. isth. 6.5, long. acul. 3—4 μ. T. XII, f. 9, after WALLICH Mscr. No. 192, f. 1.

13. **A. incavatus,** n. sp. A. minimus; semicellulæ elliptico-fusiformes, dorso rotundatæ, apice rotunde incavatæ, e basi rotundo-inflatæ, angulis lateralibus sub-acutis, mucronibus brevibus 4 instructis; membrana glabra; incisura mediana lata aperta interne rotundata. A vertice visus ovalis, apicibus acutis.

Long. 10, lat. 12, lat. isth. 4, crass. 5, long. mucr. 0.5 μ. T. XI, f. 43.

Nearest to *A. tenuissimus* ARCHER (Micr. J. Sci. p. 175, t. VI, f. 50—55, 1864), but is a little larger and has only 4 mucros, none being dorsal. I have always regarded ARCHER's little Irish plant (since found in Sweden, Norway, England &c.) as a **Xanthidium (tenuissimum)** on account of its having two *pairs* of *dorsal* mucros. In the same way I would class BOLDT's form (Sibr. Chlor. t. V, f. 16) as **Xanth. hexagonum** (BOLDT) NOB., whilst I would retain BOLDT's name for the other form (f. 17), which in spite of its central inflation is in all other points correctly described as *Arths. hexagonus* by its author.

14. **A. morsus,** n. sp. A. minor, paullo latior quam longus; semicellulis indistincte hexagonis, dorso protentis sub-acute incisis, angulis basi rotundatis superioribus plus minus acuto-rotundatis; incisura mediana magna rotundata non profunda; membrana glabra; processubus 4 crassis glabris rectis parallelis apice rotundatis lateraliter positis. Corpus amylaceum in quaque semicellula singulum. A vertice visus medio late ellipticus fere circularis.

Long. 20, lat. 23, lat. isth. 6.5, long. proc. 6 μ. T. XVI, f. 33 (inter Staurastra).

This little form seems very anomalous on account of the processes being so thick and not attenuate. The nearest species is *A. pachycerus* LAGERH. (Amer. Desm. Flor. p. 244, t. XXVII, f. 23) from which it differs in the incised apices and the non-divergent-thicker arms, the vert. view is also broader in proportion. It is also like a small thick 2-angled form of *S. globulatum*, BREB.

15. **A. gibberulus,** JOSHUA (on Desm., J. Bot. p. 33, t. 254, f. 6, 1885; Burm. Desm. p. 644).

Long. 30—35, lat. s. acul. 26—29, c. acul. 52—58, lat. isth. 9—11, long. acul. 12—14 μ. T. XII, f. 5.

Central India.

I do not think the genus Arthrodesmus can be more conveniently divided than by following the suggestions of ARCHER, in Prit. Inf. pp. 736—7, 1861; the subgenera I propose are:

A. **Aplodesmus** (*ἁπλόος*, simplex; *δεσμος*, vinculum). Angulis lateralibus integris.
Typ. sp. Arth. convergens, triangularis, subulatus, gibberulus.

B. **Schizodesmus** (*σχιζω*, scindo; &c.). Angulis lateralibus fissis.
Typ. sp. Arth. bifidus.

Gen. 21. **Onychonema**, WALLICH.

(Desm. Beng. in **Annals N. H. p. 194, 1860**: ***Xanthidiastrum*, DELP.** Desm. Sub. Alp. p. 68, 1873). **Filamenta compressa, marginibus incisa; lateribus cellularum aut rotundatis vel serratis; frondes profunde constrictæ, processubus vel cornubus sub-capitatis divergentibus alternatim positis conjunctæ. G. C. W. emend.**

1. O. uncinatum, WALLICH (l. c. p. 195, t. VIII, f. 7—11; Mscr. Nos. 40, 44, 45). O. cellulis a fronte visis quadrangularibus, profunde constrictis; semicellulis apice cornua 2 oblique posita ferentibus, utroque latere uncinulis singulis incurvis præditis; angulis superioribus 2—3 dentato-serratis, rotundatis; apicibus et lateribus punctatis; sinu profundo sub-lineari extrorsum ampliato; centrali parte frondis lævi. A latere visum biglobulatum parum et rotundate constrictum, cornubus divergentibus; a vertice visum ellipticum apicibus acutum, dorso lineis rectis 2 punctorum (granulorum?) ornatum. WALLICH remarks in Beng. Desm.: »The joints in this form are somewhat more turgid than in *Sphærozosma* or *Leuronema* (*Spondylosium*), The constriction is so deep as to leave little more than a third of the entire breadth of the joint as a connecting isthmus. The segments are closely approximate. The cornua are situated obliquely to each other, at the outer thirds of the lateral (apical) surfaces; they are cylindrical, half as long as the segments are broad, and slightly capitate. Between the cornua and the claw-like processes a row of minute teeth presents itself, whilst the median line of the segments, on their outer aspects, is bordered by two rows of minute puncta. These are, however, rarely visible, except in such joints as happen to be empty. The whole of the cornua (as seen in the front view) placed on the same side of the median line and same extremity of the segments, overlap the adjoining joint in the same direction. The two sets of cornua, therefore, as seen in this view, face in opposite directions, the upper in one, the lower in another. These cornua are not mere tubercular solid excrescences, as in *Sphærozosma*, but are formed by an extension of the cell-walls, like the fingers of a glove, and are accordingly hollow for a certain distance, the tenacity of the filament being so far increased by their instrumentality that it is constantly seen to divide rather at the segments than at the joints.

In the young state, the uncinate processes are sometimes imperfectly developed, and might induce the belief, that the form exhibiting them in this state was a variety

The marginal view (of the filament) is linear, and faintly sinuate or incised, from the outline of the cornua being observable, and the constriction, which in this aspect is just discernible. In the end view, the alternating and divergent character of the cornua is very remarkable. The last feature affords a close point of resemblance, it may be observed, to the structure and apparent function of the obliquely arranged spines and cornua in some species of the genus *Biddulphiæ* (Diatomaceæ): G. C. W. p. 195, l. c.

Long. 18—20, lat. s. unc. 24—30, lat. isth. 5.5—8, crass. 11—12.5, long. unc. 3.5—4.5, long. corn. 6—7 μ. WALLICH gives long. 20—30.5, lat. 30.5—51 μ (unc. et corn. includ.?).

Forma β **tenuis** n. f.

Long. 16, lat. s. unc. 18—19, lat. isth. 4—5, crass. 10, long. unc. 1.7—2, long. corn. 5 μ. T. XVII. a. f. 14; a, b W. B. T. ad nat.; d, c, f, g. after WALLICH Mscr. × 600; β. f. 16.

WALLICH in description in Desm. Beng. omits to mention the mucous investment of the filaments, but in Mscr. 44. 45 he has figured it; from his sketches I judge the diameter of the mucous coat at 54—60 μ in front view.

2. **O. læve** NORDST. (Desm. Bras. p. 206, t. III, f 34, 1869; LAGERH. Desm. Beng. p. 5, 1888; REINSCH Contrib. Alg. Fung. p. 93, t. XV, f. 4, 1875; *Sphærozosma serratum* BAIL. Micr. Obs. p. 36, t. I, f. 14, 1850; WOLLE Desm. U. S. A., p. 30, t. IV, f. 7, 1884; *Xanthidiastrum paradoxum* DELP. Desm. Subalp. p. 68, t. III, f. 27—33, 1873).

Long. 17—20, lat. s. unc. 22—25, lat. isth. 4.5—7, long. unc. 3.5—4.5, long. corn. 6—7 μ. NORDSTEDT l. c. gives long. 16—19, lat. s. unc. 20.5—25, c. unc. 25—46, diam. tubi mucosi 48 μ.

(*var β micracanthum* NORDST. Alg. Nonn. p. 3, 1880, non observatum).

γ **minus**, n. f.

Long. 15—16, lat. s. unc. 19—20, lat. isth. 4—6, long. unc. 3—4, long. corn. 5—6 μ.

Both from Lower Bengal.

My specimens having been gathered over 30 years ago, and kept in weak spirit, have lost all trace of the mucous tube. The dimensions and figure of REINSCH l. c. are incorrect, vide NORDST. in Hedwigia p. 67, 1876. In Burm. Desm. p. 635, Mr. JOSHUA records that he observed this with zygospores; I trust he will kindly publish the figure of this conjugation, as it would be of much interest.

3. **O. Nordstedtianum,** TURNER (On Desm. p. 934, t. XV, f. 3, 1885; NORDST. Desm. Bornh. pp. 208, 213, 1888; COOKE Br. Desm. p. 6, t. II, f. 7, 1887; *O. inerme* TURNER in litt. 1884; *O. filiforme* ROY and BISSET, Jap. Desm. p. 242, 1886; NORDST. Alg. N. Z. p. 29, 1887; *Sphærozosma filiforme* JACOBS. Desm. Danmk. p. 212, WITTR. et NORD. Alg. Exs. No. 807; non *Odontella filiformis* EHRB.).

Long. 14—15, lat. circ. 18, lat. isth. 3—4, long. corn. 6—7, crass. 10 μ.

β **compressum,** n. f.

Cellulis fere tam latis quam longis, minoribus.

Long. 12—13, lat. = long., lath. isth. 2.6—3, long. corn. 4—5 μ. T. XVII, α f. 17 a b; β f. 17 c

Bengal; Northern India.

In 1883 I made two gatherings upon Strensall Common, near York, England which yielded a large number of species of Desmids. These I partly noted in the 'Algæ of Strensall Common' (Naturalist, Dec. 1883). Part of the collection I sent to Mr. A. W. WILLS, who in litt. said he had observed *Sphærozosma filiforme* therein, to which I replied that I had not noticed any plant answering to EHRENBERG's description. When I submitted my specimens of *O. Nordstedtianum* to Mr. J. ROY, in July 1886, he informed me that he had not previously observed that it was an *Onychonema*, but he felt sure that it was the same plant he had deemed to be *Sphæ. filiforme* EHR. This view is verified by inspection of No. 807 W. and N. Alg. Exsicc., communicated to them by Mr. Roy, as therein I have seen cells of this Desmid the specimens were kindly sent to me by Dr. Nordstedt. As I do not consider this as Ehrenberg's species I append further notes under Sphærozosma No. 9.

The genus Onychonema falls naturally under two sub-genera:

A. **Prionema** (*πριων*, serra; *νημα*, filum).
Filaments serrate at the sides in front view.
Typ. sp. *O. uncinatum, læve.*

B. **Colponema** (*κολπώδης*, sinuosus; &c.).
Filaments sinuate or inciso-sinuate in front view.
Typ. sp. *O. Nordstedtianum.*

Gen. 22. Sphærozosma, Corda.

(Almanach de Carlsbad, p. 207, 1835; *Odontella*, ex parte, Ehrb. Infus, et *Tessararthra* Ehr. l. c., 1838, non *Tessarthroma*, Turp. 1828; *Isthmia*, Meneoh. Synops. ex. p. p. 204, 1840, non Agardh, *Isthmosira* Kutz. Phyc. Germ. p. 140, ex. p., 1845; *Desmidium*, ex. p. Bréb. Alg. Fal. p. 65, 1835; et Ralfs in Annals, p. 253, 1842; *Schistochilum*, Ralfs in Jenner's Fl. Tunbr. Wells, p. 192, 1845, fide Ralfs; *Sphærozosma* (a) Rabh. Fl. Eur. Alg. III, p. 148, 1868)

1. **S. vertebratum** (Bréb.) Ralfs (Br. Desm. p. 65, t. VI, f. 1, 1848; Wallich Beng. Desm. p. 192; *S. elegans* Corda, l. c. t. IV, f. 37, 1835, t. IV, f. 30, 1840; Hass. Br. Fr. Alg. p. 348, t. 84, f. 1, 1845; syn. plur. in auct. ut supra).

Var. **Indicum,** n. v. F. sinu magno plus minus cuneato; semicellulis non approximatis, cum isthmo distincto.

a. Forma semicellulis sub-ovalibus lateribus rotundatis. **F. lata.**

Long. 15—17, lat. 24, lat. isth. 8, crass. 9—10 μ. T. XVII, f. 18 a c d; Wallich Mscr. No. 63.

b. Semicellulis late ellipticis lateribus acute rotundatis. **F. sub-acuta.**

Long. 14, lat. 26, lat. isth. 6—7 μ. Fig. 18 b.

»The deviations from the typical form of *S. vertebratum* which occur . . . abundantly, *although great as regards size,* are not otherwise of sufficient consequence to demand notice in this place», G. C. W. p. 192, l. c. From this it seems evident that certain other plants hereafter mentioned were considered by Dr. W. as forms of this species, although they appear, as noted by him in his Mscr. of 1855, upon different drawings.

2. **S. excavatum,** Ralfs (Br. Desm. p. 67, t. VI, f. 2, 1848; *Schistochilum excavatum,* Ralfs in Jenner Fl. Tunbr. Wells, p. 192, 1845; *Sphærozosma excavata,* Ralfs in Annals v. XVI, p. 15. t. III, f. 8, 1845; *Isthmosira excavata,* Kütz. Spec. Alg. p. 189, 1849).

α. **typica,** Ralfs f. 2, l. c. Long. 9—10, lat. 10, lat. constr. 6 μ. (Fig. e.)

β. **læve.** Rabh. Fl. Eur. Alg. III, p. 149; Rabh. Alg. Eur. sub No. 1224 b. (Fig. d.)

Long. 16, lat. 14—15, lat. isth. 6 μ; Wallich Mscr. No. 60 (cum parasitis epiphyticis!) »no granular protuberances on the joints, which are smooth», G. C. W.

γ. **granulata?** Rabh. Fl. Eur. Alg. l. c.; Alg. Eur. sub No. 1338; granulis sparsis!

— — f. **minor** a. Long. 11—12, lat. 13—15, lat. constr. 6—7, crass. 9—10 μ. (Fig. a b).

— — f. **major** b. Long. 19, lat. 14—15, lat. constr. 7 μ. (Fig. c).

The form of the sinus is different, and the granules larger than in γ a; this form = *S. excavatum var.* δ WALLICH, Beng. Desm. p. 192, t. VII, f. 17. T. XVII, f. 19.

The form γ *granulata* of RABH. is not the *Sphæ. granulatum* of ROY and BISSET (Jap. Desm. p. 242, t. 268, f. 17); but it = *S. spinulosum?* WOLLE, Desm. U. S. A. p. 31 (non p. 159!), t. IV, f. 14.

3. **S. Wallichii,** JACOBS. (Desm. Danmk. p. 211, 1875; WOLLE Desm. U. S. A.? p. 30, t. IV, f. 15, angulis non granulatis!; *S. excavatum var.* β WALLICH Desm. Beng. p. 192, t. VII, f. 15).

Long. 15—16, lat. 16—17, lat. constr. 6—7, crass. 8 μ fide WALLICH Mscr. No. 57, f. 1. T. XVIII, f. 1, 13, after WALLICH.

»Lobes abruptly truncate, their truncate surfaces flattened, with a minute tubercle at each angle, and four or more tubercles on each front view of the joints». G. C. W. p. 192. I must observe that in WALLICH l. c. »joint» = »frond» when he is describing *filamentous* forms.

T. XVIII, f. 12, »separated joints shewing the figure of each joint in the filament f. 1 more distinctly. As soon as the joints become independent (and old?) the form appears to become more marked and developed», W. Mscr. f. 4.

(The *S. rectangulare* of WOLLE l. c. p. 31, t. XLIX, f. 9, except that the apices of the cells are a little concave, would seem to be but a large broad form of the one he gives, but doubtfully, as *S. Wallichii*; I hardly think the latter can be hereto referred).

4. **S. Indicum,** n. sp. (*S. excavatum var.* γ WALLICH Beng. Desm. p. 192, t. VII, f. 16, 1860).

Long. 15—16, lat. 18—19, lat. constr. 5—6, crass. 8—9 μ.

»Lobes broadly lanceolate, constriction angular, extremities acute, with one tubercle at their apices», WALLICH l. c. p. 192.

Long. 15—16, lat. 15—19, lat. constr. 5—6, cr. 8—8.5 μ, sec. WALLICH Mscr. No. 59. T. XVIII, f. 2, after G. C. W.

5. **S. Bengalense,** n. sp. S. mediocre, paullo latius quam longum; semicellulis reniformibus, lateribus obscure 3-angulatis margine ad angulos 3—4 granulis externe et interne granulis sparsis ornatis, dorso fere planis, centrali parte frondis lævi; sinu amplo rotundato extrorsum parum constricto. Cellulæ processubus parvis sphæricis conjunctæ. A latere visum clepsydriforme medio modice constrictum.

Long. 14—16, lat. 16—18, lat. constr. 7—8, crass. 8 μ. T. XVIII, f. 5 (also in WALLICH Mscr. No. 58), a b × 350, c × 700.

6. **S. exiguum,** n. sp. S. parvum, fere tam longum quam latum; semicellulis ovalibus, lateribus rotundatis, dorso fere planis; membrana glabra; sinu valde aperto rotundato; cellulis a latere clepsydriformibus compressis, medio parum constrictis; frondes processubus minimis (sphæricis?) conjunctæ. Habitu fere *S. excavato* consimile.

Long. 7—7.5, lat. = long., lat. constr. 3, crass. 4 μ. T. XVIII, f. 16.

Much like a small and smooth form of *S. excavatum* in front view, but in lat. v. it is seen to be less constricted.

7. **S. cosmarioides,** WALLICH (Mscr. No. 49, c. icon.). S. magnum, fere duplo latius quam longum, in tubo mucoso (45 μ lat.) inclusum; semicellulis longe ellipticis, angulis rotundatis, dorso leniter convexis; membrana glabra; incisura mediana profunda ampla interne rotundata. Processus connectentes 2 (3?). Corpus amylaceum unicum in quaque semicellula.

Long. 13—16, lat. 24—26, lat. isth. 8—10, crass. 11—12 μ. T. XXI, f. 1, after WALLICH l. c.

Dr. W. says, »Filament elongated, joints twice as broad as long or nearly so; 2-lobed, lobes frequently unequal! Constriction between lobes or segments deep; ends of lobes rounded; lobes oblong-linear. Joints (fronds) connected together by short hyaline bands or glands, which are as long as broad, and about one-eighth of the diameter of the breadth of the lobes. Filament possessing in some stages a mucous sheath, about half as broad as itself. The connecting processes are very delicate, and appear to consist not of one piece, but of 2 or 3! but with $^1/_8$ in. objective cannot speak positively on this point. The double or triple nature of the connecting band would prove the affinity between this and my other new species *Trigonema*»? (*Streptonema*).

Raneegunge, Nov. 1855; G. C. W.

8. **S. vinculatum,** n. sp. S. mediocre, fere $1^1/_2$-plo latius quam longum; semicellulis subreniformibus paullo depressis, lateribus rotundatis, dorso leniter convexis; membrana glabra; incisura mediana profunda angusta lineari extrorsum ampliato. A vertice visum ovale. Cellulæ pulvinibus duplicibus brevibus crassis conjunctæ.

Long. 11—13, lat. 16—17, lat. isth. 3.5—4 μ. T. XXII, f. 18.

Northern India; J. S. legit.

S. filiformi EHR. proxima; nonne eadem species? Cellulis sejunctis non appositis. Vide species seq.

9. **S. filiforme** (EHRB.) RALFS (Br. Desm. p. 209; COOKE Br. Desm. p. 5, t. II, f. 6; LUNDELL Desm. Succ. p. 91; *Odontella? filiformis* EHRB. Infus. p. 154; Meteorp. p. 12, t. I, f. 20; *Tessararthra filiformis.* EHRB. Infus. t. X, f. 21; *Isthmia filiformis,* MENEGH. Synops. p. 205; *Isthmosira filiformis,* KÜTZ. Phyc. Germ. p. 141; Sp. Alg. p. 188). S. mediocre, vix $1^1/_2$-plo latius quam longum; semicellulis ellipticis paullo depressis, dorso leniter convexis, lateribus rotundatis, apicibus processubus parvis sub-erectis parum divergentibus obliquiter positis (e quoque apice duo) munitis; processubus inter frondes alternatim conjunctis. Frondes non appositæ, sejunctæ; processus intervenientes foraminem quasi formantes. Membrana aut glabra vel in quaque semicellula ordinibus transversis 2 granulorum parvorum ornata; sinu aut fere æquali vel cuneato, amplo, interne rotundato. A vertice visum ovale; a latere biglobulatum, medio modice constrictum. Filum in tubo mucoso inclusum.

Long. 13—14, lat. 17—19. lat. isth. 5—6, l. proc. 3, crass. 8—9 μ. T. XVII, f. 20, a b × 500; c d × 1000.

Northern India; with the preceding, No. 8.

In 1885 I made my last gathering at Strensall, before the destruction of the place by drainage (up to that it was a primæval bog!), and *inter alia* I found this form, which I noted. On comparing in 1886 with a form from Northern India I found it the same. Noticing also the form I have described as *S. vinculatum*, I was in doubt as to which of these I should refer to *S. filiforme*, this plant having, between the processes, the larger foramen or opening, as usually accepted for this Desmid, while the form of the cells themselves in the other are more like EHRENBERG's figures loc. cit. I consulted ARCHER's notes, he says, »It is distinguished from *S. excavatum* by the elliptic form of the segments separated by an acute constriction and by its larger size; and from *S. vertebratum* by the double, not single, processes connecting the joints. It is smaller than the latter, and not so bright a green in colour«; A. in Dubl. M. Club. Proc., Nov. 1868. But the little Onychonema I described (*O. Nordstedtianum*) answers this description equally well! WOLLE's description seems good, but unfortunately he does not figure the *minute details* in his t. IV, f. 5, 6, Desm. U. S. Amer., giving the diameter as 12—18 μ. My English specimens were smaller than the Indian ones, lat. and long. 15 × 12 μ; LUNDELL gives lat. = long., 11—12 μ. EHRENBERG'S dimensions in Meteorp. l. c. (calculated according to MENEGHINI 'on measurement' in Sull. Anim. Diat., 1853) give long. 10.6 μ; while KUTZING records the length as 13.5 μ. I do not regard the fact of the sinus being more or less open, or the semicells ranging from oval to elliptic, as of great moment — these plants being so subject to such variation; what is required is an authoritative criticism on the dorsal processes, and such valid criticism I cannot find! The best suggestion is that of NORDSTEDT, (Desm. Bornh. pp. 208, 213, 1888), upon COOKE's figures in his Br. Desm., t. II, f. 6, ›that a form‹ (i. e. with ovate semicells) ›yet more resembling the figure of EHRENBERG than that of TURNER appears to have been discovered.» Of the Strensall specimens (3) two were smooth, and one minutely and linearly granulate, in the original drawing the sinus is not so open as in the Indian specimens figured, but more so than in Cooke's icons l. c. However, the note under *S. vinculatum* supra, and its figure, may be considered in connection with this form; vide page 142.

In 1887 NORDSTEDT's opinion was (Alg. N. Z. p. 29) that my *Onychonema Nordstedtianum* should be *O. filiforme* (EHR.) R. and B. (Jap. Desm. p. 242); but in 1888 he considered that the identity was an open question, being doubtful thereon. I have therefore kept the plants separate.

10. S. sp.

Long. 11—12; crass. 7—8 μ. T. XVIII, f. 19.

Probably the side view of an unknown species.

* * *

The Sphærozosmata may be subdivided by the differences in their lateral margins, thus:

A. **Sphærozosma** (sensu Cordano). Lateral margins rounded or sub-angular.
Typ. sp. S. vertebratum, filiforme.

B. **Temnozosma** (τεμνω, seco; ζῶσμα, cingulum). Lateral magins truncate, plane or incavate.

Typ. sp. S. Wallichii.

C. **Oxyzosma** (ὀξύς, acer; &c.). Lateral margins acute-angled.

Typ. sp. S. Indicum, n. sp.; No. 4 supra.

Gen. 23. **Streptonema**, Wallich.

(Desm. Beng. p. 196, 1860; *Trigonema*, Wallich Mscr. 1855). Fila interrupta, triangularia, profunde pinnatifida; frondes profunde constrictæ, vittis tribus cylindraceis hyalinis e basi loborum evadentibus conjunctæ. Semicellulæ profunde trilobatæ. G. C. W. l. c.

1. **Str. trilobatum,** Wallich (l. c. Desm. Beng. t. VIII, f. 1—6, 1860; *Trigonema trilobatum*, Wall. Mscr. 39—46, 1855).

»Joints very deeply constricted, furnished on their outer surfaces with 3 stout connecting bands, which unite with those from the adjacent joints. Segments 3-lobed; bases of lobes parallel with the base of constriction.»

»This genus is allied to *Sphærozosma;* but the structure of the connecting processes is so unique as to leave no doubt of its distinct character. Seen in the front view, under the microscope . . . the lobes are distorted to some extent, and the connecting bands, in like manner, appear less direct than they ought to do.»

»The constricted portion of the joints presents a short isthmus. The segments are accordingly not very closely approximated. Each lobe is inflated towards its free extremity. In the end view the joints are triradiate; the central isthmus appearing as a circular cavity, from the margin of which the lobes arise at equal distances, and the tubercular bases of the connecting bands being placed midway between them.»

»The connecting processes or bands are marked by three transverse lines, at the central one of which the bands are somewhat thickened. When the filament breaks up, the bands disunite at either of these lines; and, at first sight, it would appear as if each band were formed by the interposition of two short cylinders attached to the projecting tubercles situated, as already described, at the base of each lobe.»

»Whilst the joints are undergoing division, the young segments are closely pressed together, and the rudiments of the connecting bands are to be seen in the form of minute flattened processes, which gradually extend outwards as the two new joints become perfect and separate, and ultimately constitute the connecting bands.»

»The sporangium is formed by the conjugation of the joints of two distinct filaments, as described in *Desmidium* and *Aptogonum* — a sac-like vesicle being protuded from the base of the opposed joints, these vesicles by degrees coalescing to form a cell, into which the endochrome is collected. Before the sporangial mass is quite mature, the filament breaks up; but several of the sporangial sacs, with their parent-joints still attached, are constantly to be met with, placed side by side, and probably retained near each other by a common mucous envelope. The cells at this period are elliptical, their ends being produced somewhat, and coalescing with the now empty joints. At maturity, the old joints are cast off entirely, the cell closes, assumes a perfectly elliptical outline, and the sporangium presents itself in a guise similar to the mature detached Sporangia seen in some of the Zygnemaceæ,» Wallich, Desm. Beng. pp. 196—7. No distinct mucous sheath!

Long. 24—28, lat. 44—54, lat. isth. 14—17, long. proc. 6—10 μ. WALLICH gives » 20—23, » 31—48, » » ? , » » 5—10 μ, Beng. Desm. p. 197.

T. XVIII, f. 18; a b fronds in f. v., W. B. T. ad nat.; c, fronds in division × 500; d. basal view; e. apical view; f. conjugation, sac formed; g, two empty fronds with sac and young zygospore; h (and d) fronds with parasitic epiphytes; after WALLICH, × circ. 450.

The zygospore is oval, when mature covered with a thick smooth (colourless?) membrane, its diameters are 36 × 28 μ.

This genus, like *Ancylonema* BERGGR. and *Pagetophila* WITTR., has the peculiarity of consisting as yet of one species only.

[WALLICH, p. 197, appends a note upon the epiphytes found by him, »The mucous matrix in which the species of this genus are imbedded often exhibits a number of pin like bodies, stuck, as it were, into every part of the joint — the heads, which are minute, oblong, granular, and of a rich green colour, being directed outwards. These growths appear to be epiphytical, and are seen also in the various forms of *Sphærozosma* and *Leuronema*» (*Spondylosium*). »Their minute size renders any examination of their characters impossible. It may be mentioned, however, that they are quite distinct from the delicate radiating lines frequently met with in the mucous envelope of the majority of the Desmidiaceæ.» Cfr ARCHER'S notes, in Proc. Dubl. Micr. Club, on Striæ in Desmid-mucus, Bacilli in mucous investments of Algæ, and on »Headed Bacteria»; the two latter in Q. Journ. M. Sci. respectively of pp. 105—6, vol. XVI, 1876, and also pp. 237—240; the former in Annals N. H. ser. 5, vol. VII, p. 341, 1881. These little epiphytes have been placed by GOBI (Notarisia p. 384, 1887) in a separate genus under the name of *Peroniella* (sec. DE TONI. Sylloge Chloroph. p. 630, who refers to a memoir on the subject by GOBI in Scripta Bot. Horti Petrop. t. I. p. 1—18, tab. 1). DE TONI considers the genus as inclining towards *Sciadium* AL. BR.; he remarks, on *P. hyalothecæ* GOBI, 'huc verisimiliter pertinent, monente cl. amico O. NORDSTEDT in litteris, formæ a cl. WALLICH in Desm. of Bengal p. 273, t. VII, f. 5 descriptæ et illustratæ quæ in nonnullis *Desmidiaceis filiformibus* ex Bengalia indicatæ sunt.»]

Gen. 24. Desmidium, AGARDH.

(Syst. Alg. p. 15, 1824, sec. WITTROCK, mut. char.; DE BARY Conj. p. 76, 1858, *Didymoprium* KÜTZ. exol.)

1. **D. Swartzii**, AGARDH (Syst. Alg. p. 9, 1824, sec. WITTR.; Consp. Crit. Diat. p. 56, 1830! *Diatoma Swartzii* AG. in Svensk. Bot. vol. VII, t. 491, f. 1—3, 1812; Dec. Alg. No. VIII; Synops. Scand. p. 118, 1817; Disp. Alg. Suec. p. 34, 1812!)

a. **typica.** Apicibus semicellularum totaliter approximatis, in fila adpressis; »foramina» nulla — ut in RALFS Br. Desm. p. 60, t. IV, a b c d.

Long. 14—15, lat. 34—39 μ; (long. 15.2, lat. 36 μ G. C. W.)

b. **minor.** WALLICH Mscr. No. 56.

Parvum; lateribus cellularum acute divergente dentatis, profunde incisis; apicibus foraminatis, partibus exterioribus (c. processubus munitis) tribus conjunctis.

Long. 10—13, lat. 20 μ. G. C. W. l. c.

c. **Brebissonii?** Kütz. (Spec. Alg. p. 190, 1849; *D. Swartzii* Bréb. Alg. Fal. t. II, sec. Kütz.; Ehrb. Infus. t. X, f. 8!) Forma ad hanc accedens.

Long. 14—17, lat. 29—31, lat. ap. 24—26 μ. T. XIX, f. 7.

The latter exhibits an inclination to the truncate form, but it is not so decided as in Ehrenberg's figure; cfr Wolle, Desm. U. S. A., t. II, f. 1; also Rabenhorst, Bacill. Sachsens, t. III, f. 41.

Dr. Wallich evidently himself saw the typical (large) form foraminated, as appears by his sketch of 7 Oct. 1855, which, as it was the first delineation of the true conjugation of *D. Swartzii*, I have reproduced in facsimile. He says, »showing how two filaments of *Desmidium* unite to form the broad ragged-looking sporangial filament. The sporangial cells are full of endochrome, whilst the joints are empty or nearly so. * * exhibit the union of the opposing cells just taking place, the fusion occuring by the contents being thrown out and meeting. The upper part exhibits the throwing-out of the cell-contents in the upper filament, without any reciprocal process occuring in the lower one, approximation in the cells not having as yet been sufficiently advanced», G. C. W., Mscr. No. 77; T. XIX, f. 8.

The copulation of *D. Swartzii* was noted by the illustratious author of the species in t. 491, f. 3, Svensk. Bot.; and in the same year (1812) in Disp. Alg. Suec. III, p. 34, he says »post copulationem ad utrumque marginem solutis»! It remained however for Wallich, in 1860, to describe the actual process: »The filaments engaged are invariably placed parallel to each other, and although cells here and there appear to be abortive, the entire number for which there are pairs gradually become fused together. . . . The process takes place in the following order. From the base of one of the constrictions a minute sac is protruded. As it extends in size, the adjacent lobes are pushed widely asunder, the proximate angles become turgid, and the endochrome, which has become condensed at this point, is gradually poured into the sac. The already conjugated cells are kept asunder by their enclosed sporangia, at a distance nearly equal to the diameter of the filament. The elongated sacs at first simply impinge upon each other. Shortly, however, they become incorporated, the interposed portion of double cell-wall is absorbed. the contents of the opposed joints coalesce, and form the large oblong or circular sporangial bodies which we find occupying the enlarged common cavities between the two conjugated filaments. Lastly, the sporangia remain for a time encysted as just described, but eventually the common cell-wall becomes either broken up or absorbed, the sporangium is invested with its own proper tunics, and, separating entirely from the parent filaments, it wanders forth on its own peculiar reproductive mission», G. C. W., Desm. Beng. pp. 190, 191.

The zygospores, like the European ones, are oval, and are 35 × 30 μ in their diameters.

The type form is to be met with both having and also wanting the oval foramina upon which alone the genus *Aptogonum* was founded by Ralfs for the congeneric species *D. aptogonum*; both b and c are normally 'foraminated', as also are the two succeding species. In the end view, the sides of *D. Swartzii* are concave.

Hab. a, b, c, Bengal; a, Northern India; also Khasia, G. von L.

2. **D. Bengalicum,** n. sp. (*D. Swartzii var. β* Wallich Desm. Beng. pp. 189, 191, t. VII, f. 2, 3, 1860; Mscr. No. 73, 1855).

Habitu fere *D. Swartzii* Agdh., cellulis $1^{1}/_{2}$-plo latioribus quam longis, medio non profunde incisis; incisura mediana cuneate aperta interne rotundata, raro cuneata; apicibus in medio incavatis ('foraminatis') fasciis projicientibus truncatis; angulis lateralibus rotundatis non angulatis nec dentatis; membrana glabra. A vertice visum triangulare, lateribus medio distincte convexis, apud angulos parum attenuatis, angulis rotundatis. Mensuræ sunt:

Long. 18—20, lat. 28, lat. apic. 15—16 μ.
» 17 , » 26, » 12 μ.
» 19 , » 27, » 14 μ.
» 16 , » 24, » 16 μ.

T. XIX, f. 1—3 a, W. B. T. ad nat.; f. 3 b—f after Wallich Mscr. l. c.; g. cell. cum parasit. endophyt.? after G. C. W., descr. abest!

The front view looks as though intermediate between *D. Swartzii* and *D. aptogonum.* It differs from both in front view in its rounded sides which are not at all angular, and also from the latter in having the sinus of diverse shape; but in the end view the diversity is most apparent, whereas that of the two species cited shows decidedly concave sides, those of *D. Bengalicum* are decidedly convex. With respect to the cuneiform apical processes, (the 'cushions' of Wallich,) they do not appear to me to exist in the *young* cells, but when older the 'foramina' appear between the fronds; and with them the little processes come simultaneously. In specimens from Khasia these processes were *very narrowly* cuneate.

Bengal, G. C. W. 1855; East India, from *Utricularia fasciculata;* Khasia, from *Utric. sp.* G. von L., 1889.

3. **D. aptogonum** Bréb. (Alg. Fal. p. 65, t. II, 1835! Menegh. Synops. p. 203, 1840; Kütz. Phyc. Germ. p. 141; Spec. Alg. p. 190; *Odontella desmidium* Ehr. Infus. p. 153 pro p., t. XVI, f. 4, 1838; *Aptogonum desmidium*, Ralfs B. Desm. p. 64, t. XXXII, f. 1, 1848; Bréb. Liste, p. 119, 1856).

Long. 15, lat. 26 μ, after Wallich Mscr. No. 54 b.

Although Wallich in Desm. Beng. has omitted this species, his sketches in Mscr. are unmistakeable. The sides protrude but little and the lateral angles are nearly rounded; median incision small, acute; much like the Italian form represented by Delponte (*Aptogonum desmidium* Delp. Desm. Subalp. t. III, f. 1). As in the European plant the sides, in the vertical view, are concave. The plane form (*β Ehrenbergii* Ktz. Sp. Alg. p. 190; *Aptogonum diagonum* Delp l. c., f. 6—10, has not been observed in India.

Bengal, G. C. W.; East Bengal, from *U. fasciculata*, G. v. L.

4. **D. Baileyi** (Ralfs) Nordst. (Alg. et char. p. 4, 1880; Alg. N. Z. p. 25, t. II, 1888; *Aptogonum Baileyi* Ralfs Br. Desm. p. 208, t. XXXV, f. 1, 1848; Wallich Desm.

Beng. p. 191, t. VII, 1860). Following the example of Dr. Nordstedt, in N. Z. Alg. p. 27, I thus arrange the forms of this species:

α. **genuina** Nordst. Cellulæ margine fere integræ, sub-rectæ, sæpe crenulis 2 distantibus minutissimis ornatæ. Sporæ late ellipticæ.

F. minor (*Aptogonum Baileyi*, Ralfs Br. Desm. p. 208, t. XXXV, f. 1; *Desm. Baileyi* Wolle Desm. U. S. Amer. p. 27, t. II, 8, 9, 12?; Nordst. l. c. t. II, f. 4, 5).

Long. 19—22, lat. 22—24 μ.

Not yet noted from India.

***F. major** (Wolle) l. c. f. 10, 11). Zygospore large, oval.

Long. 30.5—35, lat. 36—44, zyg. diam. 36 × 22 μ. T. XIX, f. 11

Bengal, in Wallich's material.

var. *β*. **Bengalense** Nordst. (l. c. p. 27; inclus.? *D. tetragonum* Delp. *v. excavatum* Schaar. Afgh. Alg. p. 247, t. V, f. 25; *Apt. Baileyi* Wallich Desm. Beng. ex p., t. VII, f. 7, 9?). Cellulæ [illegible]ine medio late excedente (crenis parvis?). Sporæ fere circulares. O. N., l. c.

Long. 20.5, lat. 23 μ, G. C. W.

» 18 , » 23, diam. zyg. 18.5 μ. T. XIX, f. 10.

γ. **coelatum** (Kirchn.) Nordst. (*Desmidium coelatum* Kirch. Alg. Schles. p. 133, 1878; *Aptogonum sp.* Wallich Mscr. No. 55, ex p.)

a. Cellulæ margine medio irregulariter incavatæ.

F. trigona, tumid at the sides and not constricted under the angles in vert. view; F. 4-gona in the same view with the sides a little incurved. Connecting processes circular in the Indian specimens.

Java, Nordst. Alg. Char. p. 4; Bengal, G. C. W. Long. 17—19, lat. 22—23 μ. In this form the centre is not distinctly incised, but rather incavate.

b. Cellulæ margine medio incisæ.

F. Italica (Rac.) Nordst. l. c. (*Aptog. coelatum B var. 3-gonum a*, Racib. Desm. Polon. p. 66; *Apt. Baileyi*, Delp. Desm. subalp. p. 62, t. III, f. 16—19). Cellulæ a vertice visæ convexæ vel lateribus subtumidis.

This seems to be an ordinary 3-angled form with incised sides, and it is hard to comprehend why Raciborski did not include the quadrangular form (*Apt. tetragonum* Delp. l. c. p. 63, t. III, f. 20—23) also under his *f. Italica*. The difference is hardly sufficient to constitute a 'variety'!

c. **f. Polonica,** (Rac.) Nordst. l. c. (*Apt. coelatum B var. trig. b, f. Polonica* Racib. l. c., t. 5 (XIV) f. 6. Cellulæ a vertice visæ lateribus subconcavis.

This is a very curious form, the concave sides being unique for this species. b and c not noted from India.

undulatum (Maskell) Nordst. l. c. (*Aptog. undulatum* Mask. N. Z. Desm. p. 302. t. XI, f. 1—4; non *D. undulatum* Corda). Cellulæ margine convexo leviter angulato-triundulatæ; a vertice visæ regulariter triangulares angulis rotundatis, lateribus fere rectis. Nordst. l. c. t. II, f. 8.

From the fig. of NORDST. 8 b it appears that the sides in vert. view of the form, 3-gona, are very convex and unconstricted at or towards the angles; 'cushions' broadly cuneate.

NORDSTEDT gives the size as long. 18, lat. 27 μ.

Not seen in India. In this, and the above forms, I have copied, for the most part, the descriptions of DR. NORDSTEDT.

ε. **Indicum,** n. f. Cellulæ margine medio rotundatæ non emarginatæ nec incisæ; 3-gonæ (f. 4-gona non visa). WALLICH Mscr. No. 54 c; »having convex edges. The end view of joint is triangular and exhibits 3 minute narrowly cuneate hyaline processes at the points of cell-junction», G. C. W. T. XIX, f. 5; the rounded projections are hardly so prominent in my figure as in WALLICH'S 54 c. In vert. view the sides are convex, contracted somewhat towards the rounded angles.

Nakoorhyall Tal, G. C. W., 1855.

ζ. **Wallichii,** n. f. Cellulæ margine centrali elevatæ et recte truncatæ, crenis vel incisuris nullis.

WALLICH Desm. Beng. t. VII, f. 5 (not very good!), 6, 8; Mscr. Nos. 54, 74. In this the sides of the 3-angled form in vert. view are as the preceding, but with round, not cuneate, processes at the angles; in the 4-angled form the sides are nearly straight. This form or var. seems to be the analogue in this species of the truncate form in *D. Swartzii*. Zygospores oval, membrane moderately thick, smooth.

3-gona long. 19—20, lat. 22—25 μ.
4-gona » 20,5—30.5, lat. = long., G. C. W.
Diam. zygs. 22 × 17.5 μ. T. XIX, f. 4.
Bengal; Northern India.

From the various figures in WALLICH'S Mscr. I feel convinced that few of hi Bengalese specimens were laterally crenate, though I think that DR. NORDSTEDT' dicta upon the crenæ in this species, Alg. N. Z. p. 26, are perfectly correct, especially as regards the typical form. In this the specimens of *f. major*, as figured, were often gently incurved at the sides. The connecting processes or 'cushions' seem liable to variation from narrowly cuneate to circular in shape.

In the interesting example of this sp. in conjugation seen and figured by me, t. XIX, f. 9, the connection of the cells is more clearly shown than in WALLICH'S No. 74 Mscr.; I cannot, however, state clearly to which form they appertain.

DR. NORDSTEDT, Alg. N. Z. l. c., remarks upon the torsion of the filaments in this genus; for my own part I cannot but agree with WALLICH, Desm. Beng. p. 186, that the 'twisting' is hardly to be deemed natural: i. e. »during their unrestrained growth in their native element.» Dr. W. adds, that he had »repeatedly examined filaments . . . without compression of any kind, in which no torsion, or but a slight amount of it, was manifest.» Remarks, therefore, upon the number of fronds in a 'convolution' are somewhat doubtful.

Gen. 25. Didymoprium, Kützing.

Phycol. Generalis p. 166, 1843; Sp. Alg. p. 189, 1849; Ralfs Br. Desm. p. 55, 1848; mut. char.; *Desmidium* sect. a, non b c, De Bary Conj. p. 76, 1858). *Desmidii* sp. auctorum restricti; cellulæ plus minus compressæ, sæpe 2-angulatæ, sine processubus intercellularibus.

. **D. cylindricum** (Grev.) Ralfs (in Annals N. H. vol. XVI, p. 10, 1845; *Desmidium cylindricum*, Grev. Scot. Crypt. Fl. p. 293, 1827; Kütz. Synops. Diat. in Linnæa p. 614 (separ. p. 86!), 1833; Ralfs in Annals vol. XI, p. 373, t. VIII, f. 1, 1843; Meneghi. Synops. p. 204, 1840; et auct. nonnull.; *Arthrodesmus? cylindricus* Ehrb. Inf. p. 142, 1838; *Hyalotheca cylindrica*, Ehr. Kurze Nachrichte, 1840; *Desmidium compressum* Corda, Obs. Micr. p. 18 (p. 203?), 1840; *Didymoprium Grevillei*, Kütz, Phyc. Gen. p. 166, 1843; Phyc. Germ. p. 141, 1845; Ralfs Br. Desm. p. 57, t. II, 1848).

Long. 32, lat. 54 μ.

One specimen only seen.

Northern India, J. S.

. **D. graciliceps**, Nordst. (Lagerh. Bidr. Am. Desm. Fl. p. 228, t. 27, f. 2, 3, 1885, as *Desmidium graciliceps*, *Desm. quadratum* Nordst. *β graciliceps* Nordst. W. and N. Alg. Exsicc. 367 et 554; *Didymoprium? graciliceps*, Nordst., Alg. N. Z. p. 25, 1888).

Long. 18, lat. 26, lat. apic. 23.5 μ.

Central India; only 4 cells seen, apparently not common.

[**f. intermedia.** This is the *D. quadratum* of Joshua, l. c. p. 635, t. XXII, f. 3. British Burmah, W. J.]

Note. I would deprecate the total fusion of this genus with its near relative *Desmidium*, except perhaps as a sub-genus. To me the greatest difference is the fact of *Didymoprium* being without the small intercellular connecting processes so characteristic of *Desmidium;* I have therefore proposed the fact of their absence as the chief ground of the restoration of Kützing's genus to its pristine rank, although with altered characters. It is true that the apical parts of the cellules are not always totally in contact, partly only touching each other, but still apical connecting 'cushions' are wanting. Cfr Hauptfleisch, Zell. Desm. t. I, f. 39, 40, 45, 52.

Gen. 26. Phymatodocis, Nordst.

(Nonn. Alg. Bras. p. 19, 1877; Hedwigia, p. 79, 1878).

Not yet observed in India.

On t. XXI, f. 9 are figured 2 cells, one of which seems abnormally produced at the angles, after Wallich Mscr. No. 326. Dr. Wallich styles it a *Je ne sais quoi*, and places it among the lower Algæ. I at first deemed it to be a compressed or 2-angled form of *Desmidium Baileyi*, analogous to the corresponding form in *D. aptogonum*. However, it has been suggested to me that these doubtful cells *possibly* may be those of a *Phymatodocis sp.;* perhaps abnormal? certainly in an abnormal position.

Gen. 27. **Leptozosma**, TURNER.

(On Desm., J. R. Micr. Soc. p. 934, t. XVI, f. 2)

Nothing nearer to this than *D. graciliceps*, supra, has been observed in India. The Rev. F. WOLLE, in Torrey Bull, p. 58, 1886, did me the honour of criticizing the form I described l. c. attributing it to *Desmidium* (*Didymoprium!*) *quadratum* NORDST., (Norges Desm. p. 49, f. 24) nearly as figured in t. XLIX, Desm. U. S. A. The fig. No. 5 is not *quadratum* but *graciliceps var. constrictum*, NORDST.; this however does not invalidate the fact that Mr. WOLLE has considered a *thick-walled* cell as a *young* Desmid-form! LAGERHEIM (Krit. Bemerk. Desm. p. 536, 1887) did not fail to observe this. NORDSTEDT (Alg. N. Z. p. 25) considers that it »looks as a *Didymoprium* (*graciliceps* or an allied form) viewed from the side». This I frankly grant, but what the plant *really* is I know not!

Gen. 28. **Gymnozyga**, EHRB.

(Berl. Monatsber. p. 212, 1840, sec. JACOBS.; KÜTZ. Phyc. Germ. p. 140, nota! 1845; *Bambusina*, KÜTZ. l. c. p. 140; *Didymoprium*, RALFS ex. p.; *Desmidium*, RALFS et BRÉB. ex. p.; *Hyalotheca*, BRÉB. ex. p.).

1. **Gym. moniliformis**, EHRB. (l. c.; JACOBS. Desm. Danmk. p. 213, 1875; *Desmidium bambusinum*, BRÉB. in Chev. Micr. p. 271, nomen solum! 1839; MENEGH. Synops. p. 204 (sp. ined.! sine descript.) 1840; *Bambusina Brebissonii*, KÜTZ., l. c. p. 140, 1845; Sp. Alg. p. 188, 1849; BRÉB. Liste, p. 119, 1856; *Desmidium Borreri*, RALFS Annals v. XI, p. 375, t. VIII, f. 4, 1843; HASSALL, Br. Fr. Alg., p. 343, t. 83, f. 9, 1845; *Hyalotheca bambusina*, BRÉB. in litt. ad RALFS, 1846; *Didymoprium Borreri*, RALFS Annals v. XVI, p. 10, 1845).

Long. 25—29, lat. 20—23 μ.

Northern India, J. S.; Khasia, ex *Utricularia sp.*, G. VON L.

These cells are a little longer and narrower than the corresponding English form.

Neither this genus nor *Didymoprium* is represented in either WALLICH's Mscr. or his gatherings from Bengal.

DR. NORDSTEDT, De Alg. et Char., No. 3, Nov. sp. Desm. Bras. 1889, divides this genus into the following sections (sub-genera):

A. **Eugymnozyga.** Cellulæ non armatæ.
Typ. sp. G moniliformis.

B. **Hoplozyga.** Cellulæ aculeis armatæ.
Typ. sp. G. armata. LÖFGR. et NORDST. l. c.

Gen. 29. **Hyalotheca**, KÜTZ.

(EHRENBERG, nomen solum, descr. invalida! 1840; KÜTZ. Phyc. Germ. p. 140! 1845; sec. WITTR. Gotl. Ölv. p. 47, 1872; *Mixotænium* pro p., DELPONTE Des. Sub. Alp. p. 50, 1873).

1. **H. dissiliens** (SMITH) BRÉB. (in RALFS Br. Desm. p. 51, t. I, f. 1, 1848; in litt. ad RALFS 1846; *Conferva dissiliens*, SMITH. Engl. Bot. t. 2464, 1812; *Desmidium muco-*

sum, Bréb. Alg. Fal. p. 65, t. II, 1835; Menegh. Synops. p. 204, ex. p., 1840; Ralfs in Annals vol. XI, p. 374, t. VIII, f. 2, 1843; *Desmidium limbatum*, Chauv. Alg. Norm. f. 6, 1836, sec. Menegh.: *Glœoprium dissiliens*, Berkeley in Annals v. XVI, p. 11, 1845; *Hyalotheca mucosa*, Kütz. Phyc. Germ. p. 140, 1845; Sp. Alg. p. 187, 1849). Formæ variæ? Wallich Mscr. No. 52.

Long. 13—33, lat. 17—39 μ. G. C. W. l. c.

The dimensions of the larger cells, as given by Wallich, appear very great, but he is a very careful observer and hence probably correct. In the figure cited the sides of the cells are very faintly incurved.

Raneegunge; July, Oct. 1855.

[*H. dissiliens* v. *tridentula* Nordst. (Norg. Desm. p. 48, f. 23) is noted by Roy in Dickie's Algæ from the Himalayas.]

2. **H. mucosa** (Mert.) Ehrb.? (Kurze Nacht.? 1840, sec. Ralfs; Ralfs Br. Desm. p. 53, t. I, f. 2, 1848; *Conferva mucosa* Mertens. Dillw. Br. Confervæ t. B, 1809; *Glœoprium mucosum*, Ralfs Annals. v. XVI, p. 11, t. III, f. 6, 1845; Hass. Br. Fr. Alg. p. 346, t. 83, f. 5, 1845; *Hyalotheca Mertensii* Bréb. in litt. ad Ralfs, 1846; *Hyal. Ralfsii*, Kütz. Sp. Alg. p. 187, 1849; *Desmidium mucosum* ex. p. Menegh. Synops. p. 204, 1840; *Desm. limbatum, var. mucosum* Chauv. l. c.; *Mixotænium armillare*, Delp. Desm. Sub-alp. v. 50, t. I, f. 13—19, 1873).

a. Long. 15—17, lat. 20—21 μ.

Northern India.

b. Long. 13—18, lat. 10—12 μ; sec. Wallich Mscr. No. 47.

The latter might stand as *var. β elongata?* The description and the sketch show the normal filament, but of small size and elongated.

Raneegunge.

3. **H. undulata** Nordst. (in Wittr. et Nordst. Alg. Exsic. No. 248, &c., 1879?) *var. producta*, n. var. H. parva, cellulæ circ. duplo longiores quam latæ, cylindricæ, sine processubus intercellularibus; medio leniter constrictæ, apicibus rotundato-planæ; cellulæ nonnullæ cum incisuris parvis a latere (divisione incipiente?); corpuscula amylacea duo in quaque cellula; membrana glabra; filis elongatis. Tubus mucosus non observatus est. A vertice visa circularis? Sec. G. C. W. Mscr. No. 61.

Long. 15—16.2, lat. 6.5—8.7, lat. apic. 4—5.7 μ fide G. C. W. l. c. T. XVIII, f. 15, × circ. 700.

This seems very near to *H. undulata* Nordst. (W. & N. Alg. 248, 262, 561 et 806), but I have not seen this plant. The Indian form is longer and of less diameter than the American one of Wolle, Desm. U. S. Amer., p. 23, t. LIII, f. 8, of which he gives the lat. as 9—12 μ.

4. **H. Indica,** n. sp. H. parva, cellulæ paullo longiores quam latæ; cylindricæ, medio sub-acute incisæ, incisura cellulam circumambiente; fila elongata. Nuclei cellularum duo, radiati. Tubus mucosus latus. Formæ:

a. *minor*. Long. 10—15, lat. 9—11, lat. apic. 7 μ. Wallich Mscr. No. 51. T. XXII, f. 17.

b. *major*. Long. 13—15, lat. 16, lat. apic. 11—13 μ. T. XIX, f. 18.

Baboosole, 23 Nov. 1855.

5. **H. minima**, n. sp. H. minima, cellulæ paullo latiores quam longæ, fila formantes, lateribus sinuatis; cellulis a fronte sub-quadraticis, angulis superioribus adhærentibus, media parte apicum aperta? lateribus aut paullo incurvatis vel minute medio incisis. Nuclei? Tubus mucosus?

Long. 8—11, lat. 9—11.5, lat. apic. 8—8.5 μ. T. XXII, f. 16.

Hyalotheca might be divided into 2 sub-genera:

A. **Mixotænium**, DELPONTE l. c. Cells with raised annuli or bands. Nearest to Gymnozyga.

Typ. sp. H. mucosa.

B. **Hyalotheca** (sens. strict.) Cells plain or indistinctly angled; sides slightly incised or undulate, not annulate. Nearest to the Zygnemeæ.

Typ. sp. H. dissiliens.

Gen. 30. **Pagetophila**, WITTR., Mscr. 1883.

WITTR. in Snons och Isens Flora, sine descr.! syn., *Chionophila* WITTR.

Algologists will be glad to see a description of this peculiar genus, and of its single species *P. Spångbergiana* WITTR. Of course it is unknown in India.

(A *generic* locality cannot be assigned, *ad interim incertæ sedis*. W. B. T.).

Summary of the Desmidieæ.

Genus.	Species.	JOSHUA, ROY and LAGERHEIM.	Total.	Percentage of forms.
1. Ancylonema	—	—	—	—
2. Mesotænium	5	—	5	0.77
3. Cylindrocystis	5	—	5	0.77
4. Penium	11	5	16	2.44
5. Closterium	24	14	88	5.80
6. Spirotænia	1	—	1	0.16
7. Genicularia	—	—	-	—
8. Gonatozygon	5	—	5	0.77
9. Tetmemorus	1	1	2	0.30
10. Triploceras	2	—	2	0.30
11. Docidium	61	10	61	9.30
12. Dysphinctium	21	7	28	4.28
13. Spondylosium	9	1	10	1.52
14 Cosmocladium	—?	—	—	—
15 Cosmarium	137	35	172	26.23
16. Euastrum	61	17	78	11.89
Transp	000	000	000	00.00
Transp.	000	000	000	00.00
17. Micrasterias	22	6	28	4.28
18. Xanthidium	17	4	21	3.05
19. Staurastrum	123	13	136	20.04
20. Arthrodesmus	15	4	19	2.90
21 Onychonema	8	—	3	0.46
22 Sphærozosma	10	—	10	1.52
23. Streptonema	1	—	1	0.15
24 Desmidium	4	2	6	0.92
25. Didymoprium	2	—	2	0.30
26. Phymatodocis	—	—	—	—
27. Leptozosma	—	—	—	—
28. Gymnozyga	1	—	1	0.15
29 Hyalotheca	5	1	6	0.92
30. Pagetophila (Wittr. undescr.)	—	—	—	—
24 Genera species	536	120	656	100.00.

These percentages of species may be usefully compared with the rather remarkable results given by Dr. R. Boldt, in Desmidicernas utbredning i Norden, p. 109, 1887. It appears that the percentages of Micrasteriæ, Euastra, Docidia, and Xanthidia are greater in the warmer climates; while Closteria, Cosmaria and Penia give a higher percentage in the Arctic & Sub-artic regions; the percentage of Staurastra (excepting Spitzbergen and Beeren Island) is about the same as in India.

Ord. III. ZYGNEMEÆ, Menegh. Organogr. p. 33, 1838.

Gen. 1. **Zygnema,** Agdh.

2. **Zygogonium.** Kütz.

3. **Spirogyra,** Link.

The gatherings include fragments of plants belonging to these genera, but, except one doubtful *Spirogyra*, all are infertile and indeterminable.

Ord. III. MESOCARPEÆ, De Bary.

Gen. I. **Mesocarpus,** Hass. 1843.

1. **M. parvulus** (Hass.) De Bary, Conjug. p. 80, t. II, f. 15; Hass. Alg. p. 169, t. XLV, f. 2, 3; *M. splendens*, Kütz. Tab. Phyc. V, p. 1; Sp. Alg. omissus? Sphærocarpus parvulus Hassall Annals v. XII, p. 187, t. VII, f. 16.

   Northern India.

Gen. II. **Staurospermum,** Kütz. Phyc. Gen. p. 278, 1843.

1. **S. sp.**

   Central India.

Fragment in which the conjugation of two threads is incipient.

Cohors 2. **SIPHONEÆ** (Grev.), J. G. Agardh.

Ord. I. CHARACIEÆ (Nag.) Wittr. Gotl. Sötv. p. 32.

Gen. 1. **Ophiocytium,** Nag. 1849; *Closteridium*. Reinsch 1888; *Reinschiella*, De Toni 1889.

1. **O. cochleare** (Eichw. 1847) Braun 1855, Alg. unic. p. 54; *Spirodiscus cochlearis*, Eichw. Nachtr. Inf. p. 301, t. 8, f. 4; fide Wittr.
2. **O. majus** Naeg. (Einz. Alg. p. 89, t. IV A, f. 2, 1849).

   Northern India.

Gen. 2. **Characium.** Braun in Ktz. Sp. Alg. p 208.

1. **C. angustum,** Braun Alg. Unic. p. 36. t. III B.

   Northern India, on decaying Algæ.

Gen. 3. **Hydrocytium,** Braun Alg. Unic. p. 24.

1. **H. macrosporum,** n. sp. H. dimensione irregularis; cellula ovata, apicibus acuminata (fere ut in *H. acuminatum*, Braun) sed tubo parvo vel foramine apicali instructa; sporis 2—4 magnis longe ovalibus includentibus.

Long. 50, lat. 39 μ.
» 58, » 45 .
» 65, » 52 »
Spores » 39, » 19 »

T. XX, f. 32; also in WALLICH Mscr. No. 339.

WALLICH says, the apical processes are »traversed by a very delicate tubular canal.»

Cohors III. VAUCHERIACEÆ, J. E. ARESCHOUG.

Ord. I. VAUCHERIEÆ, DECAISNE.

Gen. 1. Vaucheria, DC.

1. **V. sp.**, in fragmentary condition only.

Bengal; Central India.

Cohors IV. VOLVOCINEÆ (EHRB.) COHN.

Ord. I. VOLVOCEÆ.

Gen. 1. Pandorina, BORY; PRINGSHEIM; sec. NORDST.

1. **P. morum** (BORY) EHR. Infus. p. 53, t. XI, f. 33; PRINGSHEIM, Copul. d. Zoosp., t. 17, 18, f. 1—7.

Central India.

Gen. 2. Eudorina, EHRB. Monatsb., 1831.

1. **E.? Wallichii**, n. sp. WALLICH Mscr. No. 347.

The description WALLICH gives is as follows, »A group of eight globular bodies (enclosed in orbicular cells) having a green endochrome within; ranged in two regular squares, one above the other, but twisted round, so that the lower are seen between the upper cells. They are enclosed in a delicate, almost invisible, mucous matrix. and are thereby retained in position.» G. C. W.

Diam. interior cell 8.5—9.7 μ; diam. outer cell 60—65 μ. T. XXI, f. 10 × circ. 400.

Gen. 3. Gonium, MÜLLER 1773.

1. **G. pectorale**, Müll. Vermium &c., p. 60.

Northern India.

Cohors V. CHLOROZOOSPOREÆ, J. E. ARESCHOUG.

Ord. I. PALMELLACEÆ, NAG. Einz. Alg. p. 61; emend.

Gen. 1. Oocystis, NAG.

(in BRAUN Alg. Unic. p. 94, »Genus Naegelianum ineditum, species (*O. Naegelii* BR.) nova minime rara cellulis oblongis viridibus, nunc solitariis, nunc binis, quaternis aut octonis cellula matricali membranacea firma simplici inclusis.»)

1. **O. sphærica**, n. sp. Cellulæ hyalinæ globosæ, interne familias 2—8 cellularum ellipticarum includentes. Cellulæ juveniles forma irregulariter sub-sphæricæ.

Diam. outer cell 65; inner cell, long. 32, lat. 13 μ.

In Mscr. No. 329 WALLICH depicts the young cell as irregular in form, and with 8 small elliptical internal cells. The mature form, WALLICH No. 352, is quite spherical, and shews internally 7 large daughter-cells. This form seems near to the *O. gigas*, an Irish plant, of ARCHER, in Dubl. Club Proc., Q J. Mic. Sci. p. 105, 1877.

2. **O.? mammillata**, n. sp. O. sub-circularis, paullo longior quam lata, apicibus paullo depressis; apice in centro rotundata vel distincte mammillata; divisio verticalis; a vertice visa perfecte circularis. WALLICH Mscr. 186, 188.

Long. 18, lat. 15.2 μ, G. C. W. T. XXI, f. 14 × 1500.

2. **O.? brunnea,** n. sp. WALLICH Mscr. No. 348.

Cell with pale brown mucous contents, »of an oblong form, contained in a proper membrane, having 2 orbicular cells placed in the direction of its long axis, which nearly fill up the entire length, and are pressed closely together at the centre. These cells appear filled with perfectly clear colourless fluid or mucus, and have at their inner margins each a reddish-brown granular nucleus. Outer cell membrane punctated.» G. C. W. l. c.

Long. 38, lat. 27 μ. T. XXI, f. 7, after WALLICH, × 600.

Gen. 2. **Nephrocytium,** NÄG., Einz. Alg. p. 79.

1. **N. Agardhianum,** NÄG. l. c. var. **minus,** t. III C, f, d e f.

Diam. cell. 9—12.5 μ.

Northern India, J. S.; Eastern India, ex *Utricularia flexuosa*, G. v. L.

Gen. 3. **Raphidium,** KÜTZ. Phyc. Germ. p. 144.

1. **R. aciculare,** BRAUN in RABH. Exs. No. 442; *Ankistrodesmus acutissimus*, ARCH. in Micr. J. t. XII, f. 44—56, 1862; *Closterium subtile*, BRÉB. Liste, p. 155, t. II, f. 48; *Rhaphidium polymorphum* var. γ aciculare, RABH. Alg. III, p. 45.)

Long. 35—48, lat. 2—2.5 μ.

Northern India.

This little plant is usually (sec. ARCHER in Mic. Journ. p. 255, 1862) deemed to be the same as *Closterium Griffithii* BERKELEY (Annals. v. XIII, p. 256, t. XIV, f. 2, 1854), but the latter is much larger, long. 65—85, lat. 4—5 μ, and truly a *Closterium*. Mr. ARCHER's views as to the relation of *Clos. subtile* BRÉB. are in all probability correct; but I must, with due deference, doubt Mr. JOSHUA's observation (Burm. Desm. p. 652) »*C. subtile* BRÉB. Conjugated, with quadrate zygospores», and consider that Mr. J's diagnosis of *the species* was in error.

2. **R.? spirale,** n. sp. Cellulis longis acutis, spiraliter contortis; in fasciculis conjunctis.

Long. 32, lat. 2.2 μ. T. XX, f. 26 × 850; after WALLICH Mscr. No. 316.

Gen. 4. **Dictyosphaerium,** NÄG.

1. **D. reniforme?** BULNH. in Hedw. II, p. 22, t. II, f. 6; RABH. Alg. Exs. No. 789; Fl. Eur. Alg. III, p. 47; ARCHER in M. J. Sci., p. 65, 1868.

F. major, n. f.

Cell. long. 25, lat. 9—17 μ. WALLICH Mscr. No. 332 B.

Dr. WALLICH says »A mass of kidney-shaped cells, some single, some double-attached back to back, or having smaller ones inserted by their convex edges into the concavity of the larger ones . . . . Each cell or double cell is attached *to a pale pink stem* by slender filaments of similar colour».

T. XX, f. 28, after WALLICH.

[I regret that Dr. WALLICH has not figured a whole group, but only a couple of cells; from his description it seems *stipitate*, and if so it is a *Cosmocladium* (larger than either *C. pulchellum* BRÉB. or *C. Saxonicum* DE BARY)! Should this form eventually prove to be a *Cosmocladium* it might stand as *C. Bulnheimii*, NOB.]

Gen. 5. **Hydrocystis** (gen. ad interim).

1. **H. hydrophila,** n. sp. Cellula sphærica achroa hyalina, supra superficiem cellulas reniformes vel elongatas virides (apice sæpe brunneas vel purpurascentes) adpressas ferens. Cellula in centrali parte nucleata, ut Cl. Wallichio visa: interne mucosa?

Diam. cell. 72; long. cell. exter. 28—57, lat. 20—25 μ. T. XX, f. 27 × 200 after WALLICH Mscr. 332 A.

Baboosole, Oct. 1855.

Gen. 6. **Gloeocystis,** NÄG. Einz. Alg. p. 65.

1. **G. sp.** *G. vesiculosæ* NÄG., l. c. accedens sed paullo major.

Central India.

Gen. 7. **Botryococcus,** KTZ. Spec. Alg. (Appx.) p. 892, 1849.

1. **B. Braunii,** KTZ. l. c.

Malabar, ex *Utricularia stellari,* G. v. L.

Gen 8. **Gloeotænium.** HANSGIRG

in Sitz-ber. d. K. Böhm. Ges. p. 10, 1890; Nova Notarisia, pp. 264 5, 1890; STOCKMAYER in Sitz-ber. K. K. Zool.-bot. Ges. Wien, Bd. XLI, 1891, c. icones.

1. **G. Loitlesbergerianum,** HANSG. l. c. WALLICH Mscr. 340, 348.

Dr. WALLICH says, »The cell has two membranous coats, one hyaline and continuous, the other (opaque) with apertures in it made by a broad central band. In front view (a b) the apertures are elliptical; in side view (c d) of very paradoxica form, in this view the bands are continued upwards, with truncate extremities, prolonged and rounded at the central portion of the ends.» . . . »The cell having burst and discharged its contents, by rupture of the junction of one longitudinal band at each or either side of the transverse band (e) the spore cells (f) are ejected. These are 5 or 6 in number, each having a projecting process attached; and being partially filled with green granular endochrome.» In original cell 2 endochrome masses. The outer membranous coat is purple or purplish-brown, the cell-contents are vivid green, in colour.

Long. 48, lat. 25—33; spores long. 9, lat. 8 μ.

The plant figured by WALLICH conforms well with the 2-celled form of STOCKMAYER's description, l. c.

T. XXI, f. 12, after G. C. W.

It seems very debateable as to what position in classification this Alga shall take — but observers will hardly agree with the existing suggestion that it is near to *Spirotænia* (or any Desmid); the name of the new Order, proposed to include it, *Pseudodesmidiaceæ,* is, to say the least, rather misleading. In all probability it is nearer to *Gloeocystis* and *Tetraspora* than to the Desmidieæ.

Ord. II. PROTOCOCCACEÆ (MENGH.) RABH.

Gen. 1. **Closteridium,** REINSCH.

(Fam. Polyedr. Monogr., 'Notarisia' p. 510, 1888; *Reinschiella* DE TONI Sylloge Chlor. p. 612, 1889. *Ophiocytium* ex p. RABH. Flor. Eur. Alg. III, p. 66; WOLLE Fr. Alg. U. S. Amer. p. 175 ex p., non NAEG.)

1. **Cl. Bengalicum,** n. sp. C. minus, curvatum, semi-lunatum, utroque fine attenuato-apiculatum; massas pardulas gregariter formans. Habitu fere *Closterio* (*Closteridio!*) *cuspidato* BAILEY (in RALFS' Br. Desm. p. 219, t. XXXV, f. 11) accedens sed multo minus.

Long., across arc of cell, 16, lat. 6, long. spin. 5—6 μ. T. XX, f. 25, after WALLICH Mscr. No. 322.

»Endochrome granular», G. C. W.

This plant is nearest to *Closteridium capitatum* (WOLLE) NOB., WOLLE l. c. p. 176, t. 158, f. 3—7, from which it differs in the apices being attenuate.

[There appears to be little reason for the alteration, by Dr. DE TONI in Sylloge l. c., of this generic name!]

Gen. 2. **Polyedrium,** NÄG., Einz. Alg. p. 83; REINSCH Monogr. 1888.

1. **P. tetraëdricum** NÄG. Einz. Alg. p. 84, t. IV, B 3 f. b c.

Long. 18—23, lat. 16—20, lat. centr. 7—10 μ.

β torsum, n. f.

In this form one half of the frond is twisted at right angles to the other half. T. XX, f. 15 × 600; after WALLICH Mscr. No. 292, f. 2, 3.

2. **P. trigonum,** NÄG., l. c., t. IV B, f. 1.

Long. 10, crass. 5 μ. Sec. G. C. W. Mscr. No. 295. T. XXI, f. 13.

Raneegunge, Nov. 1855.

3. **P. bifidum,** n. sp. P. trigonum, lobulatum, angulos versus attenuatum; angulis productis bifidis; a latere visum lanceolatum utroque fine attenuatum.

Long. 13—17, crass. 4.5—5.5 μ. T. XX, f. 23 × 1000; after WALLICH Mscr. No. 294.

Can this possibly be a triangular Pediastrum, allied to such a form as *P. Sturmii*, REINSCH, Alg. Frank. t. VII, f. 1 a?

4. **P. proteiforme,** n. sp. P. magnum, indistincte lobulatum, 2—3-gonum, angulos versus attenuatum; angulis magis productis sinuatis acutis; a latere visum (3-gonum) acuto-lanceolatum.

Long. 65, crass. 12 μ. F. 3-gona, lat. s. proc. 36 μ.

T. XX, f. 24; a. f. 2-gona, b. f. 3-gona; after WALLICH Mscr. No. 287.

The forms have apparently a habit of crossing each other, which is suggestive of Kützing's *Micrasterias cruciata* (Syn. Diat. p. 71, t. VI, f. 86); the sinuous apices are remarkable.

5. **P.? sp.** Diam. 37, long. sp 2 μ. T. XVII, f. 11.

This form seems intermediate between *P. tetraedicum* NÄG. and *enorme* RALFS (cfr REINSCH l. c. t. V, f. 3 b, and VII, f. 2 a.

Gen. 3. **Staurophanum**, n. g.

Frons plus minus cruciformis, normaliter 4-partita, vel 4-lobulata, ad fines aut singula aut furcata, angulis vel non productis; anguli interiores rotundati; apicibus 2—3 dentatis vel cuspidatis; a latere visa lanceolata, finibus plus minus attenuatis.

1. **S. cruciatum** (WALLICH) NOB. *Micrasterias cruciata*, WALL. Desm. Beng. p. 281, t. XIII, f. 12, 1860; G. C. W. Mscr. No. 83.
   F. majus, n. f. Long. et lat. 48—54 μ. T. XX, f. 21, × 670.
   F. minus, n. f. » » 24—28 μ. T. XX, f. 20, »
   Bengal; Central India.
2. **S. pusillum** (WALLICH) NOB. *Micrasterias pusilla*, WALLICH l. c., t. XIII, f. 13; Mscr. No. 80. Both this and the preceding are bluntly-lanceolate in lat. view.
   Long. et lat. 25, crass. 10 μ. T. XX, f. 22.
   Under this genus, which is allied to *Polyedrium*, NAG., I would (whilst not interfering with *Polyedria genuina*,) include such stauriform and lobate plants as the *P. gracile* of REINSCH, Monogr. Polyedr. p. 502, t. VII, f. 1 (*St. gracile* (RNSCH) NOB.).

Gen. 4. **Thallodesmium**, n. g.

Plantula minuta (plana?) sub-orbicularis, in stratum gelatinosum tenue nidulans vel libere natans; ex cellula unica margine sinuata vel incisa pilis rectis brevibus instructa, medio profunde constricta, constituta. Massæ chlorophyllaceæ irregulares, sub-radiatim dispositis.

1. **T. Wallichianum**, n. sp.
   Under this I give a little plant of very uncertain location, which at first sight looks like a Desmid. Dr. WALLICH, in Mscr. No. 327, says, "Composed of 2 nearly identical segments. The general outline is jagged and sinuous, exhibiting an inciso-lobate appearance, the edges being furnished with short straight hairs. Constriction though not symmetrical is well marked. The endochrome is in irregular masses, disposed somewhat radially; it is more yellowish-green than usual in these organisms. The form is the normal one, and seems to be sub-symmetrical."
   Long. 39—52, lat. 33—45 μ. T. XX, f. 31, after WALLICH; × 450.
   Bengal; common, G. C. W.
   This plant is very peculiar, and seems to be a small aquatic thallophyte. I would propose the above name for such a unique form on account of its pseudo-Desmidian appearance.

Ord. III. PEDIASTREÆ, NAEG.

Gen. 1. **Pediastrum**, MEYEN, Nied. Alg. p. 772, 1828!

(*Micrasterias*, EHRB. et KÜTZ. ex. p. 1831—1840; non AGDH.

1. **P. tetras** (EHRB.) RALFS in Annals, p. 469, t. XII, f. 4, 1844 ex. p.; *Micrasterias tetras*, EHRB. Inf. p. 155, t. XI, f. 1; *Pediastrum Ehrenbergii* (CORDA) A. Br. Unic. Alg. p. 97, t. V, H f. 2.
   In WALLICH Mscr. No. 310; diam. 20 μ.
   Forma 1 + 7, BRAUN l. c. H, f. 4; WALLICH Mscr. 303 d; diam.?
2. **P. Sturmii**, REINSCH, Alg. Frank. p. 90, t VII, f. 1 b; forma.

Wallich Mscr. No. 313, ex. p.

Frond long. et lat. 27; sp. inclus. 57 × 50 μ. T, XX, f. 17.

3. **P. simplex,** Meyen, Nied. Alg. p. 772, t. XLIII, f. 1—5, 1828; Braun Unic. Alg. p. 80; Reinsch Alg. Frank. t. VII, f. 4.

Wallich Mscr. No. 314, f. 1.

In Wallich l. c., No. 314, f. 11, there is a form of this with 9 rays = 4 + 9.

4. **P. incavatum,** n. sp.

This small form, of about 22—28 μ diameter, seems to differ in its incavate apices from any I have observed. Wallich gives it in his Mscr. No. 314, f. 7.

T. XXI, f. 21, after G. C. W.

Diam. 22—28 μ.

5. **P. gracile,** Al. Braun, Unic. Alg. p. 92; Reinsch Alg. Frank. p. 94, t. VII, f. 2; forma bidentata.

Form exactly, as in Reinsch's fig., but minutely bidentate at the apices. Wallich Mscr. No, 305.

Diam. circ. 40 μ. T. XX, f. 16 × 700.

6. **P. rotula,** Kütz. Phyc. Germ. p. 143, No. 8; Näg. Einz. Alg. p. 95, t. V B, f. 3 b; non Braun, l. c. t. VI, f. 1—14!

This much resembles the figure of Nägeli l. c., but the apices of the cellules on each side of the incision are squarely truncate. Wallich Mscr. No. 302, f. 1.

7. **P. selenæa,** Kütz. l. c., No. 4; Ralfs Br. Desm. t. XXXI, f. 5?; Näg. l. c. B, f. 2.

Wallich Mscr. No. 300, 302. (302 = 1 + 7 + 13 + 15).

8. **P. Boryanum** (Turp.) Mengh. Synops. p. 210; *Helierella Boryana*, Turp. Mem. Mus. XVI, p. 318, 1827; *Micrast. Boryana*, Ehrb. Abhl. p. 390, 1835; fide Braun; Racib. Ped. p. 12, 1889.

Wallich Mscr. No. 304 = 1 + 5 + 11 + 15.

Long. 90, lat. 76 μ, G. C. W.

9. **P. constrictum,** Hassall, Fr. Alg. p. 391, t. 86, f. 15, 16, 1845; Racib. Pediast. p. 30, t. II, f. 44; *P. ellipticum* Ralfs ex p. Br. Desm. t. XXXI, f. 10 d.

Wallich Mscr. No. 312, a b, (both a et b, 5 + 11).

Long. 41, lat. 36 μ. G. C. W.

10. **P. duplex,** Meyen, l. c. p. 772, 1828; f. asperum (*P. pertusum var. ε asperum*) Braun l. c. p. 93; Racib. Pediastr. p. 25.

Wallich Mscr. No. 298 (1 + 5 + 11 + 14!)

Frons circularis; diam. 98 μ.

11. **P. sp.** formæ; after Wallich Mscr.

T. XX, f. 12; W. No. 314, f. 3 — f. 13; W. No. 314, f. 4.

Formæ cellulis confusis; inevolutis?

Pediastra of curious form (undeveloped?) are not uncommon in gatherings in which the genus is well represented. In Meyen's original memoir (1828), he notices such forms under *S. duplex* Mey., f. 1—17.

Various *Pediastra* in Wallich's Mscr. are not determined.

Gen. 2. **Coelastrum,** NAG. Einz. Alg. p. 97.

1. **C. Indicum,** n. sp. Cœnobium e pluribus cellulis sphærice dispositis, constitutum. Cellulæ fere rotundatæ, conjungentes, membrana externa crassa hyalina; cytioplasmate luteola-viride. Inter cellulas opercula visa sunt, formâ sub-triangularia.

Cœnob. diam. 48, diam. cell. 10—12 μ. sec. G. C. W. Mscr. No. 325. T. XX, f. 11, after WALLICH.

Raneegunge Tanks; Nov. 1855. Common, G. C. W.; British Burmah ex *Utricularia* sp., G. v. L.

2. **C. distans,** n. sp. Cœnobium e pluribus cellulis irregulariter dispositis constitutum. Cellulæ sphæricæ, isthmis vel processubus brevibus conjunctæ (5 proc. a fronte visis); membrana crassa hyalina; cytioplasmate viride nitente. Inter cellulas opercula irregulariter hexagona visa sunt.

Diam. cellularum circ. 6.5 μ. T. XXI, f. 18 × 1000; after WALLICH Mscr. No. 317.

Raneegunge Park: July. G. C. W.

3. **C. sphæricum,** NÄG. Einz. Alg. p. 98, t V c, f. 1; KTZ. Sp. Alg. p. 195; 1849.

Eastern India, ex *Utricularia fasciculata*. G. v. L.

Gen. 3. **Sorastrum,** KÜTZ. Phyc. Germ. p. 144.

1. **S. spinulosum,** NÄG., Einz. Alg. p. 98, t. V D. WALLICH Mscr. No. 346.

Long. cell 13, lat. 9.7 μ; spin. long. 4 μ.

Bengal, G. C. W.; Khasia, ex *Utricularia* sp., G. v. L.

(At T. XX, f. 9 is represented a side view of a cell (sp. unknown) with *pectinate* angles! after WALLICH Mscr. No. 350 a, and my own sketch No. 92. It seems to be a Sorastrum in form, but the size is great; long. 40, crass. 13 μ!)

Gen. 4. **Scenedesmus,** MEYEN, Nied. Algf. p. 774, 1828.

1. **S. obtusus.** MEYEN l. c. p. 775, t. XLIII, f. 30—31; RALFS Br. Desm. p. 193, t. XXXI, f. 16: KUTZ. Phyc. Germ. p. 139.

Central India.

2. **S. quadricauda** (TURP.) BRÉB. Alg. Fal. p. 66; MENGH. Synops. p. 206; RALFS Br. Desm. p. 190; *Achnanthes quadricauda*, TURP. Dict. Sci., 1820; *Scenedesmus magnus* MEYEN, l. c., f. 26, 27, 29; et *Sc. longus* ejus f. 28!

F. major, RALFS l. c. t. XXXI, f. 12 b; WALLICH Mscr. No. 284.

Long. 27, lat. 16.5, l. spin. 8—11 μ. T. XX, f. 19, b c; after G. C. W.

This curious form has foramina (between the component cellules) which are 2.5 μ in diam.

F. minor. RALFS l. c. f. 12 c. (mostly of 2 cellules only!)

Cells long. 12, lat. 3.7; spin. long. 6.5 μ.

The form shewn at f. 19 a is a 2-celled form dividing, »at the lateral portion two hyaline pale straw-coloured globules (mucus?) are seen», G. C. W.

3. **S. acutus,** MEYEN l. c. f. 32; RALFS l. c. t XXXI, f 14.

Long. cell. 13, lat. 2.7—3.3 μ. WALLICH Mscr. No. 289.

Note. A remark is made by NORDSTEDT, in N. Z. Alg. p. 19, upon *S. Hystrix*, LAGERH. Stock. Pediastr. p. 62, t. II, f. 18; I would ask, Is not that either the same as, or a form of, *Arthodesmus* (Scenedesmus) *serratus*, CORDA, Obs. &c., p. 244, t. VI, f. 35, 1839?

Gen. 5. **Selenastrum**, REINSCH Alg. Fr. p. 64.

1. **S. gracile**, REINSCH l. c. p. 65, t. IV, f. 3; forma. WALLICH Mscr. No. 345.
   Long. cell. 13, lat. 3.2 μ.
2. **S. Bibraianum**, REINSCH, l. c. p. 64, t. IV, f. 2.
   Long. cell. 23, lat. max. 5—6 μ? T. XXI, f. 15, after WALLICH Mscr. No. 323.
   Searsole, Oct. 1855, G. C. W.
3. **S. acuminatum**, LAGERH. Stock. Pediastr. p. 71, t. III, f. 27—30, 1882; LAGERH. in W. & N. Alg. Aq. dulc., fas. 9, No. 441. WALLICH Mscr No. 296.
   Long. cell. centr. 45—48, exter. apic. ad apic 33—38 μ; crass. cell. circ. 4 μ. T. XX, f. 30, × 650; after WALLICH.

Gen. 6. **Crucigenia**, MORREN, 1830.

(Ann. Sci. Nat. t. XX, p. 404; *Micrasterias*, KÜTZ. Syn. Diat. p. 73; *Staurogenia* KÜTZ. Sp. Alg. p. 194).

1. **C. quadrata**, MORREN. l. c., t. XV; *Staurogenia quadrata*, KÜTZ. l. c.; BRAUN unicell. p. 70; *Pediastrum quadratum*, MENGH. Synops. p. 212.
   Northern India.
2. **C. rectangularis** NÄG. in BRAUN Unic. Alg. p. 70, as *Staurogenia rectangularis;* RABH. Fl. Eur. Alg. III, p. 80. WALLICH Mscr. No. 293. *Chloropedium rectangulare* NÄG.
   Long. cell. mass. 38, lat. 26.5; 4-cellulæ long. 13, lat. 7.4—8.2 μ. T XXI, f. 17 (after WALLICH) × circ. 750.

Ord. IV. ULOTHRICHEÆ, KÜTZ. Phyc. Gener. p. 179, 1843.

Gen. 1. **Ulothrix**, KÜTZ. l. c.; Alg. Dec. No. 144, 1836.

1. **U. tenerrima**, KÜTZ. Phyc. Germ. p. 197, 1845; Sp. Alg. p. 346; Tab. Phyc. II, t. 87, f. 1.
   Artic. diam. 7.7—9.2 μ.
   Central India.
2. **U. zonata** (W. and M.) KÜTZ. Phyc. Gener. p. 251, t. 80; *Conferva zonata*, WEBER et MOHR, fide KÜTZ. Sp. Alg. p. 347.
   Artic. diam. 19—23 μ.
   Northern India.

Ord. V. CONFERVACEÆ (AGDH.) RABH. Fl. Eur. Alg. III, p. 318.

Gen. 1. **Conferva** (LINK) WILLE, sec. NORDST.

1. **C. fontinalis**, BERK. Gl. Br. Alg. t. XIV, f. 1; KÜTZ. Tab. Phyc. III, t. 45, f. 4.
   Artic. diam. 15—17 μ.
   Northern India.

2. **C. tenerrima,** KÜTZ. Tab. Phyc. III, t. 42, f. 1; Phyc. Germ. p. 202.
   Artic. diam. 4—5.3 μ.
   Northern India.

Gen. 2. **Cladophora,** KÜTZ. Phyc. Germ. p. 207; Phyc. Gener. p. 263.

1. **C. crispata,** KÜTZ. l. c. p. 215; Phyc. Gen. p. 264; Tab. Phyc. IV, t. 40, f. 1; *Conferva crispata,* DILLW. Br. Conf. t. 93: forma ad Form. II longissima, RABH. (*Clad. longissima?* KÜTZ. l. c.) accedens.
   Artic. diam. 67 μ.

Gen. 3. **Rhizoclonium,** KÜTZ. Phyc. Gener. p. 261.

1. **R. fontanum,** KÜTZ. Phyc. Germ. p. 206; Sp. Alg. p. 386.
   Artic. diam. 14—16 μ.
   Northern India.

Ord. VI. CHÆTOPHOREÆ (HARV.) WITTR. Gotl. Sötv. p. 25.

Gen. 1. **Stigeoclonium,** KÜTZ. Phyc. Gen. p. 253.

1. **S. protensum?** KÜTZ. Phyc. Germ. p. 198; Sp. Alg. p. 355; *Conferva protensa,* DILLW. Br. Conf. t. 67.
   Doubtful!

Cohors I. **ŒDOGONIACEÆ** (THUR.) WITTR. Oedog. Suec. 1870.

Ord. I. ŒDOGONIEÆ (DE BARY) PRINGSH.

Gen. 1. **Œdogonium,** LINK 1820.

1. **Œ. crispum** (HASS.) WITTR. Prodr. Monogr. Oedog. p. 10, sec. NORDST.; *Vesiculifera crispa,* HASS. Br. Fr. Alg. p. 203, t. 52, f. 8! *Oedog. nodosum* KÜTZ. Phyc. Germ. p. 200; Sp. Alg. p. 365.
   A plant very near this species.
   Central India.
2. **Œ. undulatum** (BRÉB.) Al. Br. in DE BARY Algengatt. Oed. u. Bolb. p. 94; WITTR. Oedog. Suec. p. 130; *Conferva undulata* BRÉB.; *Cymatonema confervaceum,* KÜTZ. Tab. Phyc. III, t. 47, f. 1; sec. WITTR. l. c.; Sp. Alg. p. 375!
   Artic. long. 56—82, lat. 14—16; lat. bas. cell. 31 μ. T. XXI, f. 20, a basal cell × 300, after WALLICH Mscr. No. 344; b. portion of filament, × 500.
   Bengal; very common.

Œ. sp.

Forma ad *Oe. Londinensi* WITTR. Mon. Oedog. p. 39 accedens? T. XX, f. 33, × 300? after WALLICH Mscr. No. 334.

This curious form seems a little abnormal; WALLICH's sketch shows several oogonia, the lower one oval, the 3 central and continuous ones, and the upper one also, globose. The filament and the three lower oogonia are depicted full of dark green chlorophyll; the upper portion of the fourth and the whole of the fifth are hyaline and empty (h); the upper oogonium only containing a few dark granules, probably aborted? The terminal oogonium (c) contains a small spherical dark green body (aborted oospore?), the remainder being filled bv a reddish-orange coloured granular mass.

(Various fragments of Oedogonia are undetermined).

Ord. II. COLEOCHÆTEÆ (NAG.) PRINGSH.

NÄG. Neuen Algensyst. p. 166, 1847; PRINGSH. Beitr. Morph. Alg. III, p. 32; sec. WITTR.

Gen. I. **Coleochæte,** BRÉB. Descr. gen. d'alg. p. 29, 1844; sec. WITTR.

1. **C. scutata,** BRÉB. l. c., t. 2, f. 1—7; PRINGSHEIM, l. c. p. 35, t. I, f. 4; t. III, f. 3, 4; t. IV, f. 3; fide WITTR. Alg. Gotl. p. 17.

Northern India.

2. **C.? sp.**

T. XXI, f. 11 × 500, after WALLICH Mscr. No. 321.

This singular form has a quadrangular frond composed of 4 cellules, with small spines 8.5 μ long rising from the external angles, the spines being a little uncinate although erect; from the centre a larger spine, 16 μ long, arises. The chlorophyll masses are not continuous, but each cellule is distinct. If this be a Coleochæte it is a very aberrant form.

Fig. 11 a, basal view, is a little oblique; b lateral view.

Long. 23, lat. 20, long. exter. sp. 8, l. inter. spin. 16; crass. 14.5 μ.

Bengal; G. C. W.

3. **C.? sp.** (helicoïdea).

In WALLICH'S Mscr. No. 350 b a curious form, analogous to this and the preceding genus, is represented. The frond is orbicular, and composed of 19 cellules arranged in a helicoid manner, somewhat as in certain *Pediastra*, the outer cellules being of course the longest and narrowest. The cellules do not approximate, but, as in *Coleochæte scutata*, they are separated by small spaces in the thallus. No descr. of this or dimensions is given by WALLICH. There are no setæ or little spines attached to the cellules! If this proves to be a *Coleochæte* it might stand as *C. helicoïdea*, NOB.

The following organisms also appear in DR WALLICH'S memoranda, but I deem them to be of fungal and not truly algoid character:

1. **Olpidium Indicum,** n. sp. O. habitu fere *Olpidio ampullaceo* Al. Br. (Chytrid. p. 66, t. V, f. 24—27!) accedens, sed paullo minor; tubula breviora et externe planeque expansa.

Long. 7, lat. max. 5.5 μ. T. XXI, f. 8; after WALLICH Mscr. No. 334.

Parasitic upon *Oedogonium sp.*

2. (Gen. et sp.?)

»A long cylindrical cell of a pale brown colour, containing a series of orbicular or oblong cellules, strung together by contracted processes of the investing membrane common to them all. The processes vary in number, forming bands. The cells themselves have an additional inner coat proper to each one; their surfaces appear covered by numerous circular spaces, probably empty portions of the common membrane. The cell-contents are of a pale dusky brown in colour and minutely granular»; G. C. W., Mscr. No. 328.

Long. 344, lat. 36; diam. cellules 20—32 μ. T. XXI, f. 19 (long. abbrev.); after WALLICH.

Raneegunge, Nov. 1855.

[For other endophytic forms, see under t. XII, f. 12; t. XVII, f. 19 d; t. XVIII, f. 18 h; and t. XIX, f. 3 g. Cfr note, and authorities cited, under *Arthrodesmus convergens.*]

APPENDIX.

In the interim between the journey of my Mscr. to Sweden, and its revision by me, I have discovered, from Eastern India, a fragment of a curious *Penium* which I believe to be new, and which I have previously seen from North America (U. S. A.), and from Perthshire, Scotland. This I have described in litt. c. icone (apud J. ROY) as *P. Royanum* mihi. I may thus briefly state it:

1. **Penium Royanum,** n. sp. P. rectum, cylindricum, oblongum, medio tumidum, utraque apice leniter attenuatum, apicibus late rotundatis incrassatis, longitudinaliter spiraliter striatum, striis (circ. 12) minutorum granulorum compositis, striis transversis remotis 5—7 instructum, apud quamque striam transversam paullo constrictum, lateribus leniter 6—8 undulatis; membrana pallide rufescens.

Long. 112—168, lat. max. 21—27 μ. T. XXIII, f. 7.

The measurements are those of the American and Scottish plants, with which the fragment fully accorded.

Hab. [Minnesota, U. S. A.; near Loch Earn, Perthshire;] E. Bengal ex *Utricularia flexuosa,* G. v. L.

This is near to *P. spirostriolatum* BARKER, mentioned by JOSHUA l. c., concerning which and another congener (about both of which some doubt seems to exist,) I take leave to subjoin a few remarks with diagnoses.

2. **P. spirostriolatum,** BARKER (Proc. of Dubl. Micr. Club, in Q. Journ. Mic. Sci. IX, p. 194, 1869; XI, p. 93, 1871; WOLLE Fr. Alg. U. S. Amer. p. 22, t. LXI, f. 17; non TURNER J. Micr. Soc. 1885 ut infra; *Closterium spiraliferum* JACOBS. Desm. Danmk. p. 177, t. VII, f. 8; *P. Haynaldii β lineare* BOLDT? Sibir. Chlor. p. 120, t. VI, f. 42.)

P. rectum, plus minus turgidum, versus apices distincte et medio vel non sensim attenuatum, apicibus truncato-rotundatis plerumque paullo dilatatis incrassatis striis longitudinalibus parallelis 11—13 plus minus tenuibus spiraliter instructum; striis transversis remotis 5—9 evidentibus; lateribus vix vel magis undulatis, membrana hyalina vel apicibus brunneis vel tota luteolo-rufescente aut fusco-brunnea. Dimensiones:

Specim. Amer. l. et lat. max. 165 × 24; 156 × 22; 262 × 28 μ; comm. F. WOLLE.
» Scotl. » » 186 × 19; 220 × 19; 280 × 20; 284 × 22 μ; comm. J. ROY.
» Sibir. » » 220 × 19.2 μ, BOLDT l. c.

In the specimens with dilated apices (by far the commoner form) the lt. apic. is 13—16.5 μ, when undilated the lt. apic. is 11—12 μ.

There is considerable variation in size and general appearance of this plant. DR. NORDSTEDT in litt. deems it to be the same as *P. Haynaldii* SCHAAR. (Magy. Desm. p. 277, f. 20, 1882); judging from Scandinavian specimens this may be so, but Schaarschmidt's figure is hardly satisfactory; its size is 150 × 20 μ.

Swedish specimens from Blekingia, et W. & N. Alg. No. 574, give:
Long. et lat. max. 140 × 25; 152 × 27; 170 × 23; 162 × 27; 182 × 25 μ.

These are shorter and thicker and have the apices less dilated than any other form of the plant I have seen; more so than the Norwegian specimens I have from Orenvand (J. W. ADDYMAN, Swedish and Norwegian Vice-consul in Leeds, legit), and they are also very different from the Scottish ones, which Mr. ROY informs me are *typical*, as they are not so long or so uniform in the sides. The colour of the membrane is colourless or pale reddish-yellow (luteolo-rufescens), and the striæ are normal.

Specim. Nord. long. et lat. max. 168 × 21; 194 × 20.5; 220 × 23; 226 × 22 μ.

I have not seen any specimen with membrane 'brun foncé' as noted by JACOBSEN, but I quoted this in the diagnosis.

Hab. [Ireland, BARK.; Scotl. ROY; Sweden, W. & N.; Norway, J. W. A.; U. S. A., WOLLE; Hungary? SCHAAR.; Siberia, BOLDT]; British Burmah, JOSHUA. T. XXIII, f. 3, 4, 5.

A decidedly congeneric form is

3. **P. Scandinavicum,** n. sp. (TURNER in litt. apud DR. NORDSTEDT 1887; *P. spirostriolatum* T. on Desm., J. R. Mic. Soc. p. 939, t. XVI, f. 26, 1885; *P. spir. var.* WOLLE Fr. Alg. p. 23, t. LXI, f. 19).

P. rectum, turgidum, ad apices leniter attenuatum, medio modice constrictum, apicibus rotundatis vel rotundato-truncatis valde incrassatis; costis longitudinalibus 6—8 crassis sub-parallelis spiraliter positis, et striis transversis 7—11 remotis (apud quamque striam transversum paullo constrictum), instructum; lateribus leniter 8—12 undulatis. Membrana hyalina vel ad apices vel tota fusco-brunnea. Dimensiones:
Specim. Amer. l. et lat. max. 194 × 26; 227 × 23; 260 × 31 μ.
» Norw. » » 176 × 24; 208 × 23; 219 × 27; 247 × 29 μ.

The Scandinavian plants are not so attenuate in the central part as the American ones; indeed, one of the latter was figured by me (f. 26 a, l. c.) which I came to consider was a 'double cell', i. e. not disconnected after cell-division, but I was in error. This Desmid is very near to the preceding ones; I here insert it solely for correction and the purpose of re-description.

Hab. [U. S. Amer.; Norway, Orenvand, Dyrknutskjön, J. W. A., Fiskeland W. B. Russell]. T. XXIII, f. 6.

4. **Spirotænia? sp.**

Endochrome nearly destroyed; two specimens only.

Long. 70—76, lat. 10.5—12 μ. T. XXIII, f. 15.

Himalayas? J. S.

5. **Closterium crassestriatum?** ARCHER (in Proc. Dubl. Micr. Club 1878, in Q. Jl. Mic. Sci. p. 120, 1879), *forma?*

Described by ARCHER as very robust, considerably curved, and very strongly striated, the striæ (costæ?) few. Nearest to *Cl. costatum* CORDA, which species the New Jersey (U. S. A.), Scotch and Irish specimens exactly resembled. Not ventrally inflated. Zygospore large, smooth, suborbicular and thick-walled, seemingly not at all remaining attached to the parent cells. Specimen from New Jersey.

This form may be thus described:

Cl. semilunare, turgidum, utroque apice valde attenuatum, medio vix inflatum, apicibus truncato-rotundatis, striis transversis medianis 2—3, costis longitudinalibus 9—11 evidentissimis; membrana fusco-luteola.

Long. 326—382, lat. max. 49—58 μ. T. XXIII, f. 8 × 250.

I first saw this at Bowness, Engl. in 1885, but until lately I considered it as only a var. of *C. costatum*, however, on comparing 2 Indian specimens with that species, I think it must be considered as distinct therefrom; the costæ are interrupted at the median fascia.

Hab. [England]; Himalayas, from *Utricularia stellaris*, G. v. L.

(On submitting figure of this form to Mr. ARCHER, he kindly informs me that it is very close to, if not identical with, his Cl. crassestriatum).

6. **Micrasterias rotata** (GREV.) RALFS, **f. evoluta,** n. f.

Forma latiuscula, laciniis apertis, lobulis bicuspidatis, lobo polari ornato exserto. Specimen unicum observavi.

Long. 282, lat. 262 μ. T. XXIII, f. 1 × 425.

Though WALLICH reports this sp. from Bengal (vide No. 9 under the genus) I did not see it in his material. This form much resembles one sent me years ago by MR WOLLE from America, but it is smaller and not so deeply incised. E. Bengal, ex *Utricularia flexuosa*, G. v. L.

Note. As I find in the interim that the name *C. gradatum* has been appropriated by my friend Mr. ROY (Desm. Alford Dist. p. 203) for another *Cosmarium*, I alter the name of my plant p. 68 to *C. scalare.*

Finally, I venture to express my sense of the great indebtedness of British Algophiles to Scandinavian authors, whose great erudition is only equalled by their courtesy and generosity. W. B. T.

12 Oct. 1892.

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EXPLICATIO ICONUM.

Nisi aliter indicatum est, icones omnes 500-es amplificatæ sunt.

TAB. I.

Fig. 1. Dysphinctium dubium, n. sp.?
» 2.
» 3. Mesotænium chlamydosporum? DE BARY.
» 4. » Braunii DE BARY.
» 5. Cylindrocystis ovalis, n. sp.
» 6. Mesotænium sp.?
» 7. Penium lanceolatum, n. sp.
» 8. » sub-lamellosum, n. sp.
» 9. » navigium, n. sp.
» 10. » bisporum, n. sp. × 550.
» 11. Spirotænia truncata, ARCH.
» 12 Closterium Kuetzingii, BREB. after WALLICH.
» 13. » Wallichii, n. sp. a. empty frond, shewing the peculiar triple suture, × 400; b. extremity, highly magnified, after WALLICH.
» 14. Closterium acutum, BREB. f. tenuior NORDST. × 600.
» 15. Closterium acerosum (SCHRANK) EHRB., f, ad *Cl. peraceroso* GAY accedens, × 400.
» 16. Closterium Ehrenbergii, MENEGH. × 450.
» 17. » arcuatum, BREB. × 400.
» 18. » Leibleinii KÜTZ. var. angulatum BALS. f. minor, × 400.
» 19. Mesotænium? giganteum, n. sp.
» 20. Closterium tumidulum, GAY.
» 21. Dysphinctium inferum, n. sp.?
21* » exile, n. sp.
» 22. Penium oblongum, DE BARY, forma major.
» 23. Mesotænium caldariorum? (LAGERH.) HANSG.
» 24. Cylindrocystis? minutissima, n. sp.
» 25. Closterium Wittrockianum, n. sp., × 200.
» 26. Dysphinctium conicum, n. sp.
» 27. Penium digitus (EHR.) BREB. f. rectum, n. f.

TAB. II.

» 1. Triploceras gracile. BAILEY; forma δ elongata.
» 2. β gracillima.
3. Triploceras γ quadrilobata.
Fig. 4. Triploceras gracile, BAILEY; * bilobatum, nov. sub-sp
» 5. Docidium mammillatum, n. sp.
» 6. Docidium perlæve, n. sp.
» 7. » œdematum, n. sp.
» 8. » robustum, n. sp.
» 9. » quantillum, n. sp. Cfr t. IV, f. 12.
» 10. » æquale, n. sp. forma monstrosa. Cfr t. III, f. 11.
» 11. Docidium cylindricum, n. sp.
» 12. » salebrosum, n. sp.
» 13. » polymorphum, n. sp. Cfr f. 17. and t. IV, f. 13.
» 14, 15. Docidium egregium, n. sp.
» 16. Docidium elatum ,n. sp.
» 17. » polymorphum, n. sp. Cfr f. 13, and t. IV, f. 13.
» 18. Docidium rhomphæum, n. sp.
» 19. » longiusculum, n. sp.

TAB. III.

1. Docidium sub-coronulatum, n. sp.
» 2. » Wallichianum, n. sp.
» 3. » eugeneum, n. sp.
» 4. » Bengalense, n. sp.; × 500, c. × 250.
» 5. » gloriosum, n. sp.
» 6. » regale, n. sp.
» 7. » nodosum (BAIL.) RALFS. 7 a var. γ dentatum, forma Indica; 7 b apex of var. β Anglicum.
» 8. » Sonthalianum, n. sp.
» 9. Penium simplex, n. sp.
10. Docidium sceptrum, ROY; forma punctata.
11. » æquale, n. sp. Cfr t. II, f. 10.

TAB. IV.

» 1. Docidium orientale, n. sp.
2. » excelsum, n. sp.
3. » maculatum, n. sp.
4. » Ehrenbergii RALFS. var. γ tumidum.

Fig. 5. Docidium setigorum, n. sp.
6. » conjunctum, n. sp.
» 7. » cristatum, n. sp.
» 8. Indicum GRUNOW, forma major.
» 9. » irregulare, n. s.; after WALLICH.
10. truncatulum, n. sp.
11. » abruptum, n. sp.
» 12. » quantillum, n. sp. Cfr t. II, f. 9.
13. » polymorphum, n. sp. Cfr t. II, f. 13, 17.
14. Docidium crispulum, n. sp.
» 15. » baculiforme, n. sp.
16. » undulatum, BAILEY.
17. Triploceras abbreviatum, n. sp. After WALL.
18. Docidium parvum, n. sp. After WALLICH.
» 19. Triploceras gracile BAIL. semic. juvenilis, after WALLICH.
20. Docidium inornatum, n. sp.

TAB. V

1. Micrasterias tropica, NORDST.
2. » Mahabuleshwarensis, HOBS., var. excelsior (WALLICH) NOB.
3. Micrasterias pinnatifida (KÜTZ.) RALFS. a, e, f. *α* typica; b, *β* quadrata, n. f.; c, *γ* expansa, n. f.; d, *δ* inflata, WOLLE; f. g, formæ monstrosæ.
4. Micrasterias crux-melitensis (EHRB.) RALFS. a, f. *α* typica; b, f. *β* compressa n. f.; c, f. *γ* minor, n. f.; d, f. *δ* lata, n. f.; e, f. *ε* robusta, n. f.; f. forma *ζ* alata, n. f.; g, f. *η* gracilis, n. f.
» 5. Micrasterias furcata, RALFS. a, f. *α* typica; b, forma *β* gracillima, n. f.; c, forma *γ* expansa, n. f.
6. Micrasterias radians n. sp. a, f. *α* typica; b, f. dentata.

TAB. VI.

» 1. Micrasterias Mahabuleshwarensis, HOBSON; f. major, n. f.
» 2—5. Micrasterias alata, WALLICH. Fig. 3, 5, *α* typica; 2, var. *β* depressa, n v.; 4, zygospore.
» 6. Micrasterias lux, JOSHUA. Cfr t. XXII, f. 2.
» 7—11. Micrasterias incisa (BREB.) RALFS. *α* typica, f. 8, 10; *β* Wallichiana n. f., f. 7, 9; *γ* aculeata, n. f, f. 11.
12—15. Micrasterias foliacea, BAILEY. Fig. 12—14; fig. 15 zygospore.
16—18. Micrasterias stauromorpha, n. sp.

TAB. VII.

» 1. Docidium latum, n. sp.
» 2 a rotundatum, n. sp. 2 b, sutural region of Doc. inerme, n. sp
» 3. Docidium pyriforme, n. sp.

Fig. 4. Dysphinctium sub-turgidum, n. sp.
» 5. » grande DELP. var. cuneatum, n. v.
» 6. » connatum (BREB.) REINSCH.
» 7. Penium polymorphum, PERTY.
» 8. Cylindrocystis diplospora? LUND.
» 9. Tetmemorus Brebissonii, RALFS. forma.
» 10. Dysphinctium retusum, n. sp.
» 11. Cylindrocystis? depressa, n. sp.
» 12. Penium rotundum, n. sp.
» 13. Dysphinctium monile, n. sp.
» 14. » heterodoxum, n. sp., var. ornatum, n. v.
» 15. Dysphinctium heterodoxum, n. sp.
» 16. » aspersum, n. sp.
» 17. Euastrum (Eucosmium) subintegrum, NORDST., var. Indicum, n. v.
» 18. Cosmarium serratum, n. sp.
» 19. » contractum, KIRCHN.; lat. v. Cfr f. 33, 34, 38; t. IX, f. 21.
» 20. Cosmarium tithophorum, NORDST. f. irregularis.
» 21. » concinnum (RABH.) REINSCH.
» 22. læve, RABH. Cfr t. VIII, f. 21.
» 23. » perpastum, n. sp.
24. » Boldtii, n. sp.
» 25. » Regnellii, WILLE, *β* minor.
26. » » *α* major.
» 27. » noduliferum, n. sp.
28. » crenatum, RALFS, forma.
» 29. » mordax, n. sp. Cfr t. IX, f. 7.
» 30. » Bissetii, n. sp.
» 31. » maculatum, n. sp. Cfr t. VIII, f. 68.
» 32. Cosmarium tumescens, n. sp.
» 33, 34. » contractum, KIRCHN. Cfr f. 19, 38; t. IX, f. 21.
» 35. Cosmarium auriculatum, REINSCH. Cfr t. IX, f. 8.
» 36. Cosmarium punctulatum BREB., forma KLEBS (*C. Klebsianum*). Cfr t. VIII, f. 16, 53.
» 37. Cosmarium trinodiferum, n. sp.
» 38. » contractum KIRCHN., var. punctatum. Cfr supra.
» 39. Cosmarium ctenoideum, n. sp. Cfr t. VIII, f. 59.

TAB. VIII.

» 1. Cosmarium centrosphinctum, n. sp.
» 2. » corruptum. n. sp.; cfr t. IX, f. 40.
» 3. sub-circulare, n. sp. Cfr f. 7; t. IX, f. 27, 37.
» 4. Cosmarium sp. (*C. galeritum* NORDST. forma?)
» 5. » microsphinctum? N. and WITTR.; f. parvula, n. f. (p. 52).
» 6. Cosmarium quadrans, n. sp.
» 7. » sub-circulare, n. sp.; var. *β* rugosum, n. v. Cfr supra; t. IX, f. 27, 37.
» 8. Cosmarium octogibbosum RNSCH. *β* Indića T. = (Cos. Hammeri REINSCH ex. p.). Cfr t. X, f. 14.

Fig. 9. Cosmarium **vittatum**, n. sp.
» 10. **isthmochondrum**? NORDST., var. β achondrum, n. v.
11. Cosmarium **apertum**, n. sp.
» 12. » **cycladatum**, n. sp.
» 13. » **bicrenatum**, n. sp.
» 14. » **coloratum**, n. sp.
» 15. » **Hammeri**, REINSCH, f. **acuta**. Cfr t. IX, f. 34.
» 16. Cosmarium punctulatum, BREB., var. depressum, n. v. Cfr f. 53, et t. VII, f. 36.
17. Cosmarium pygmæum, ARCHER.
» 18. » exiguum, ARCHER, f. minor.
» 19. » Willsianum, n. sp.
» 20. » **pygmæum**, ARCHER.
» 21. » læve, RABH. **forma**? Cfr t. VII, f. 22.
» 22. » **armillatum**, n. sp.
» 23. » **homalodermum**, NORDST. var. β rotundatum, WILLE. Cfr f. 62.
» 24. Cosmarium **bidentatum**, n. sp.
» 25. » **Meneghinii**, BREB. forma tricrenata, n. f.
26. Cosmarium **laciniatum**, n. sp.
» 27. » **tenerum**, n. sp.
» 28. » **Jeneseijense**, BOLDT; forma.
» 29. » creniferum, n. sp.
» 30. » **munitum**, n. sp.
» 31. » **puteale**, n. sp. Cfr t. XXII, f. 9.
» 32. Euastrum sculptum, n. sp.?
» 33. Cosmarium **Bengalense**, n. sp. Cfr t. IX, f. 33.
» 34. Cosmarium nigro-cirratum, n. sp.
35. » **angulatum**, PERTY. f. **major** GRÜN. Cfr t. IX, f. 25.
36. Cosmarium alatum, KIRCHN. var. Cfr f. 57.
» 37, 38. **supergranatum**, n. sp. 37, f. **minor**; 38 f. media. Cfr t. IX, f. 24.
» 39. Dysphinctium Cohnii (KIRCH.) NOB.; **var.** regulare, n. v.
» 40. Dysphinctium Willei, n. sp.
» 41. Cosmarium **inane**, n. sp.
» 42. Dysphinctium **basi-decorum**, n. sp.
» 43. Cosmarium **melanosporum**? ARCHER, **forma** orientalis.
» 44. Cosmarium erosum, ARCHER; f. minor.
» 45. » **pseudocoronatum**, n. sp.
» 46. » insigne, n. sp.
» 47. » **incavatum**, n. sp. Cfr t. XXII, f. 7.
» 48. » **rotundum**, n. sp.
» 49. » **pseudo-protuberans**, KIRCHN., **forma**. Cfr t. X, f. 6.
» 50. » **scabro-latum**, n. sp.
» 51. » **Portianum**, ARCHER, **forma**.
» 52. » **triceps**, n. sp.
» 53. » **punctulatum** BREB., **f. β rotundatum** KLEBS. Cfr f. 16, et t. VII, f. 36.
» 54. **Cosmarium Aitchisonii**, SCHAAR. Cfr t. IX, f. 18.
» 55. **Cosmarium Gangense**, n. sp.
» 56. » **peregrinum**, n. sp.

Fig. 57. Cosmarium **alatum**, KIRCHN, f. Cfr f. 36.
» 58. » **innotum**, n. sp.
» 59. » **ctenoidum**, n. sp. Cfr t. VII, f. 39-
» 60. » **Arnellii**, BOLDT, **forma**.
61. » **scenedesmum**, DELP. var. γ punctatum, n. v.
» 62. Cosmarium **homalodermum**, NORDST., α typica. Cfr f. 23 supra.
» 63. Cosmarium obsoletum (HANTZSCH) REINSCH, f. major.
» 64. Cosmarium taxichondrum, LUND. var. nudum, n. v.; lat. v. f. 64 *
» 65. Cosmarium **palustre**, n. sp. Cfr t. IX, f. 1, 29.
» 66. » **forte**, n. sp.
» 67. » **rugosum**, n. sp.
» 68. » **maculatum**, n. sp.; forma. Cfr t. VII, f. 31.

TAB. IX.

1. Cosmarium palustre, n. sp. var. β ovale. Cfr f. 29; t. VIII, f. 65.
2. Cosmarium præcelsum, n. sp.
3. » **panduriforme**, n. sp.
» 4. » **Sikhimense**, n. sp. Cfr f. 36.
» 5. **Dysphinctium supraconnatum**, n. sp.
» 6. **Cosmarium striatum**, BOLDT, f. **Indica**, n. f.
» 7. » **mordax**, n. sp. Cfr t. VII, f. 29.
» 8. » **auriculatum**, REINSCH; var. β verrucosum, n. v. Cfr t. VII, f. 35.
» 9. **Xanthidium** cosmariforme, n. sp.; f. evoluta, n. f. Cfr t. XII, f. 17.
» 10. **Cosmarium** sp. (C. perizosmum? **var.** γ granulatum).
» 11. Cosmarium concentricum, n. sp.
» 12. » **perizosmum**, n. sp.
» 13. » » var. β ornatum, n. v.
» 14. » cuneatum? **JOSH.** var. **Indicum**, n. v.
» 15. sub-quasillus, **BOLDT**; var. tropicum, n. v.
» 16. **Cosmarium** sp.
» 17. » ptilotum, n. sp.
» 18. » **Aitchisonii**, SCHAAR., var. punctatum, n. v. Cfr t. VIII, f. 54.
» 19. **Cosmarium Tittaghurense**, n. sp.
» 20. » **medioglabrum**, n. sp.
» 21. » **contractum** KIRSCHN.,? var. punctatum. Cfr t. VII, f. 33, 34, 38.
» 22. **Cosmarium paradoxum**, n. sp.
» 23. » **staurochondrum**, LEM. var.
» 24. » **supergranatum**, n. sp. f. pulchrum. Cfr t. VIII, f. 37, 38.
» 25. » **angulatum**, PERTY, f. major GRÜN., lat. v. Cfr t. VIII, f. 35.
» 26. **Cosmarium** proteiforme, n. sp.
» 27. **sub-circulare**, n. sp.; lat. v. Cfr t. VIII, f. 3, 7; f. 37 infra.
» 28. **Cosmarium Norimbergense**, REINSCH, var. microscopicum, n. v. Cfr f. 43.
» 29. **Cosmarium palustre**, NOB. α **circularis**, f. minor. Cfr f. 1; t. VIII, f. 65.

Fig. 30. Cosmarium sexangulare, LUND. var. Bengalense, n. v.
» 31. Cosmarium æquale, n. sp.
» 32. » scabrum, n. sp.
» 33. » Bengalense, n. sp.; lat. view. Cfr t. VIII, f. 33.
» 34. Hammeri, REINSCH, f. B minus, RNSCH. Cfr t. VIII, f. 15.
» 35. Cosmarium orientale, n. sp.
» 36. Sikkimense, n. sp.; lat. v. Cfr f. 4.
» 37. » sub-circulare, n. sp.; basal v. Cfr f. 27 supr.; t. VIII, f. 3, 7.
» 38. Cosmarium scutellum, n. sp.
» 39. » dulciferum, n. sp.
» 40. corruptum, n. sp. Zygospore, after WALLICH. Cfr t. VIII, f. 2.
» 41. Cosmarium pseudo-Broomei, WOLLE.
» 42. » impressulum, ELFV., f. minor.
» 43. » Norimbergense, REINSCH, forma? Cfr f. 28.
» 44, 45. Cosmarium moniliforme (TURP.) RALFS; formæ.
» 46. Cosmarium pulchellum, n. sp.
» 47. » tetrophthalmum (KÜTZ.) BREB. Forma.
» 48. Cosmarium sp. (*C. consperso* RALFS, β *rotundatum* WITTR. accedens).
» 49. Cosmarium spiculiferum, n. sp.
» 50. » Indicum, n. sp.
» 51. Euastrum clepsydra, WALLICH.
» 52. Cosmarium sp. Forma monstrosa egregia! after G. C. W. × 600. Species *C. punctulato* BREB. accedens.

TAB. X.

1. Cosmarium scalare, n. sp.
2. Euastrum nobile, n. sp. × 700.
3. Cosmarium depressum (NÄG.) LUND.
4. » Barrackporeanum, n. sp.
5. » occidentale, n. sp. (= *C. gemmatum*, TURNER 1885). v. ornatum n. v.
6. Cosmarium pseudo-protuberans, KIRCHN., f. typica. Cfr t. VIII, f. 49.
7. Cosmarium prominens, n. sp.
8. » bacciferum, n. sp.
9. Dysphinctium qualum, n. sp.
10. Cosmarium umbonatum, n. sp.
11. » macrosporum, n. sp.
12. » octogonum, n. sp.
13. » Raneegungense, n. sp.
14. » octogibbosum RNSCH., β Indica, f. minor. Cfr t. VIII, f. 8.
15. Cosmarium Cambricum, COOKE et WILLS; f. minor, n. f.
16. Cosmarium rectosporum, n. sp.
17. Euastrum subspinosum, n. sp., α typica. Cfr f. 37.
18. Euastrum erosum, LUND., f. β attenuata. Cfr f. 21.

Fig. 19, 20. Cosmarium venustum, BREB. formæ. Cfr f. 24 infra; t. XI, f. 2.
» 21. Euastrum erosum, LUND., f. β attenuata. Cfr f. 18.
» 22. Euastrum sp. (*E. erosum* LD. et *Cos. crenatum* RALFS intermedium).
» 23. Euastrum erosum, LUND., f. γ undata.
» 24. Cosmarium venustum, BREB. forma.
» 25, 26. » pusillum BREB.: 25, var. retusum; 26, forma?
» 27. Cosmarium granatum, BREB. forma.
» 28. Euastrum turgidum, WALLICH, α typicum.
» 29. » » » var. β Grunovii, n. v.
» 30. Euastrum binale (TURP.) RALFS, f. d. subsecta, n. f.
» 31. Euastrum simplicius, n. sp. Cfr f. 41.
» 32. » sub-stellatum NORDST., f. Bengalensis, n. sp.
» 33. Euastrum micracanthum, n. sp.
» 34. » orientale, NOB. Cfr t. XI, f. 26.
» 35. » binale (TURP.) RALFS; c. secta, n. f. Cfr f. 39, 47; t. XI, f. 5.
» 36. Euastrum annulatum, n. sp. Cfr f. 52.
» 37. » subspinosum, n. sp., f. β tumida, n. f. Cfr f. 17.
» 38. Euastrum dentiferum, n. sp.
» 39. » binale (TURP.) RALFS; c. secta, cfr supra.
» 40. Euastrum Candianum, DELP., var. munitum, n. v.
» 41. Euastrum simplicius, n. sp., f. minor. Cfr supra.
» 42. Euastrum quintanum, n. sp.
» 43. » spicatum, n. sp.
» 44. » platycerum, RNSCH, v. pulchrum, n.v.
» 45. » singulare, n. sp.
» 46. » acanthopleurum, n. sp.
» 47. » binale (TURP.) RALFS; f. c. secta, n. f. Cfr supra.
» 48. Euastrum levatum, n. sp.
» 49. » cymatium, n. sp.
» 50. » binale (TURP.) RALFS; f. a minuta, n. f.
» 51. Euastrum inermius, NORDST.
» 52. annulatum, n. sp., lat. view. Cfr supra.
» 53. Euastrum acanthophorum, n. sp.
» 54, 55. » radiatum, n. sp.
» 56. » projectum, n. sp.
» 57. » præpandum, n. sp.
» 58. » binale (TURP.) RALFS; f. b unicorne, n. f.
» 59. Euastrum ampullaceum. RALFS: var. incavatum, n. v.
» 60. Euastrum carduetum, n. sp.
» 61. » obesum, JOSH., f. glabra.
» 62. Cosmarium? sp. After G. C. W.; zygospora egregia! × 600.

TAB. XI

Fig. 1. **Euastrum incurvatum**, n. sp.
» 2. **Cosmarium venustum**, Breb. forma. Cfr t. X, f. 19, 20, 24.
» 3. **Euastrum longifrons**, n. sp. (p. 84).
» 4. » **paradoxum**, n. sp.
» 5. » **binale** (Turp.) Ralfs, f. c secta; cfr t. X, f. 35, 39, 47.
» 6. Euastrum **orbiculare** (Wallich. **a, segment with young semicell; b, c, d, other views.**
» 7. **Euastrum didelta (Ralfs?). Zygospore, after Wallich.**
» 8. Cosmarium abruptum, Lund.; forma β Gostyniense Racib.
» 9. Euastrum verrucosum, Ehrb. var. β Wallichianum, n. v.
» 9ª Euastrum **verrucosum**, Ehrb. var. γ simplex, Josh., f. **tumescens**.
» 10. Euastrum **commissurale**, Breb. var. γ Wallichii, n. v.
» 11. **Euastrum** commissurale, Breb. var δ capitatum, n. v. Cfr f. 27 infra.
» 12. Euastrum **schizostaurum**, n. sp.
» 13. » cruciforme, Wallich (mscr.).
» 14. » elegans, Breb., var. nudum, n. v. Cfr f. 16.
» 15. Euastrum nummularium, Delp., var. planum, n. v.
» 16. **Euastrum elegans, Breb.** var. **planum**, n. v.
» 17. » **Nordstedtianum**, Wolle; var. elegans, n. v.
» 18. Euastrum clavatum, n. **sp**.
» 19. » ventricosum Lund., var. Floridanum, n. v.
» 20. Euastrum Gangense, n. sp.?
» 21. » quincunciale, n. sp.
22. » divaricatum, Lund., α typica. Cfr f. 25.
» 23. Euastrum prorum, n. sp.
» 24. » stigmosum, n. sp.
» 25. » divaricatum, Lund., var. β inevolutum, n. v.
» 26. Euastrum **orientale**, Nob., lat. view. Cfr t. X, f. 34.
» 27. Euastrum **commissurale**, Breb. var. β crassum Nordst., **forma**? Cfr supra.
» 28. Arthrodesmus incurvus, n. sp.?
» 29. » **minor**, n. sp.
» 30. » **crispus**, n. sp.
» 31. » **curvatus**, n. sp.; vert. v. Cfr f. 33, etc.
» 32. » **convergens**, Ehrb., f. β curta, n. f. Cfr f. 41, 42; t. XII, f. 3.
» 33. **Arthrodesmus curvatus**, n. sp.; α typica. Cfr f. 35; t. XII, f. 2, 8, 7, 11, 13, 15.
» 34. **Arthrodesmus hiatus**, n. sp.; f. β minor. Cfr f. 40; t. XII, f. 1.
» 35. **Arthrodesmus** curvatus, n. sp.; f. β major.
» 36. » subulatus, Kütz., f. **media**. Cfr f. 39, t. XII, f. 4.
Fig. 37. Arthrodesmus **subulatus**, Kütz., f. media. Cfr f. 39, t. XII, f. 4.
» 38. Arthrodesmus **Gangensis**, n. **sp**. Cfr t. XII, f. 14.
» 39. » **subulatus**, Kütz., f. minor.
» 40. » hiatus, n. sp., f. α major.
» 41, 42. » convergens, Ehrb. 42, α typica; 41, γ minor, n. f.
» 43. Arthrodesmus incavatus, n. sp.

TAB. XII.

» 1. Arthrodesmus **hiatus**, n. sp.; f. α major, with young semicell.
2. Arthrodesmus curvatus, n. sp. f.
» 3. » convergens, Ehrb.; cell. copul. cum zygosp., sec. Wallich.
» 4. Arthrodesmus subulatus, Kütz., f. media.
» 5. » **gibberulus**, Joshua.
6. » incus (Breb.) Hass. Formæ variæ.
» 7. Arthrodesmus curvatus, n. sp.: divisio cellularum.
» 8. » » n. sp.; f. β major.
» 9. phimus, n. sp.
» 10. Indicus, n. sp.
» 11. » curvatus, n. sp.; cell. copul. cum zygosp., sec. Wallich.
» 12. Arthrodesmus convergens, Ehr., semic. cum parasit., after Wallich.
13. Arthrodesmus curvatus, n. sp.; f. major incipiens? × 550.
» 14. Arthrodesmus Gangensis, n. sp.
15. » curvatus, n. sp.; cum tegumentum mucosum, × 550.
» 16. Xanthidium hastiferum, Turner; f. angulata.
» 17. » cosmariforme, n. sp. Cfr t. IX, f. 9.
» 18. » **cristatum**, Breb., f. inornata, n. f.
» 19. » **hastiferum**, Turner; a latere, specimen irregulare!
» 20. Xanthidium cristatum, Breb. Cfr, f. 18, 31, 33; t. XIII, f. 3, 5.
» 21. **Xanthidium ineptum**, n. sp.
» 22. » **hastiferum**, Turner; divisio abnormalis, after Wallich.
» 23. **Xanthidium hastiferum**, Turner, var. Javanicum (Nordst.) Nob., f. plana, n. f.
24. Xanthidium antilopæum (Breb.) Kütz., forma depressa, n. f.
» 25. Xanthidium **hastiferum**, Turner, f. α typica.
» 26. » **hexacanthum**, n. sp.
» 27. » **cristatum**, Breb., var. leiodermum (R. & B.) Nob., f. **inevoluta**, n. f.
» 28. **Xanthidium bisenarium**, Ehrb.; var. rotundadatum, n. v.
» 29. Xanthidium **tetracanthum**, n. **sp**.
30. » **bisenarium**, Ehrb., α typica.
» 31. » **cristatum**, Breb., var. leiodermum (R. & B.) Nob., f. **irregularis**, n. f.
» 32. **Xanthidium Bengalicum**, n. sp.
» 33. » **cristatum**, Breb., var. leiodermum (R. & B). Nob.
» 34. **Xanthidium fasciculatum**, Ehr.

TAB. XIII.

Fig. 1. Xanthidium antilopæum (BREB.) KÜTZ., var. δ polymazum, NORDST., f. major, n. f.
» 2. Xanthidium bisenarium, EHRB., var. ornatum, n. v.
» 3. Xanthidium cristatum, BREB. forma; cfr t. XII, f. 31.
» 4. Xanthidium armatum, BREB., var. incongruum, n. v.
» 5. Xanthidium cristatum, BREB., var. erectum, n. v.
» 6. Xanthidium hastiferum, TURNER, forma; cfr t. XII, f. 23.
» 7. Staurastrum spinosissimum, n. sp.
» 8. Xanthidium Searsolense, n. sp.
» 9. » brevicorne, n. sp.
» 10. » pulchrum, n. sp.
» 11. » Raneegungense, n. sp.
» 12. » eximium, n. sp. Cfr t. XXII, f. 10.
» 13. Staurastrum retusum, n. sp.
» 14. » smaragdinum, n. sp. × 300.
» 15. » striolatum (NÄG.) ARCHER, f. Brasiliensis, n. f.
» 16. Staurastrum polytrichum, PERTY.
» 17. » dilatatum, EHRB., var. Indicum, n. v.
» 18. Staurastrum papillosum, KIRCHN.; forma.
» 19. » depressum, NÄG., f. aperta, n. f. × 300.
» 20. Staurastrum truncatum, n. sp.
» 21. » coroniferum, n. sp.
» 22. » margaritaceum (EHR.) MENGH.; var inornatum, n. v.
» 23. Staurastrum Borgesenii, n. sp. × 300.
» 24. » stellatum, REINSCH, v. pulchellum.
» 25. » Willsii, n. sp.
» 26. » gemmulatum, n. sp.
» 26* » æquum, n. sp.
» 27. » pinnatum, n. sp. Cfr f. 29.
» 28. » torsum, n. sp.
» 28* » ornatum (BOLDT) NOB.
» 29. » pinnatum, ut supr., var. simplex.
30. » foliatum, n. sp.
» 31. » sub-armigerum, ROY and BISSET: forma.
» 32. Staurastrum pansum, n. sp.
» 33. » triangulare, n. sp.
» 34. » Wallichii, n. sp

TAB. XIV.

» 1. Staurastrum sexangulare formæ; a f. ϑ triangularis; b f. ζ compressa.
» 2. Staurastrum quadricornutum, ROY & BISSET, f. c. zygospore.
» 3. Staurastrum galeatum, n. sp. Cfr 9, 10.
» 4. » horridum, n. sp. × 300.
5. » orientale, n. sp. (p. 123).
» 6. » furcatum (EHR.) BREB.; f. Indica, n. f.
Fig. 7. Staurastrum pisciforme, n. sp.
» 8. » saltans, JOSH.
» 9. » galeatum, n. sp.; f. 2-gona.
» 10. » » » f. 3-gona.
» 11. » Indicum, n. sp.
» 12. » leptocladum, NORDST., var. β cornutum, WILLE; a—c × 330, d × 500.
» 13. Staurastrum Bengalense, n. sp.; f. minor × 300.
» 14. » pseudo-Sebaldi, WILLE; var. β bicorne, BOLDT × 330. Cfr t. XVI, f. 14.
» 15. Staurastrum grallatorium, NORDST.
» 16. » leptocladum, NORDST.; var. β cornutum, WILLE.
» 17. Staurastrum angulare, n. sp. × 600.
» 18. » Sunderbundense, n. sp. × 400.
» 19. » quadratum, n. sp. × 300.
» 20. » arcuatum, NORDST.
» 21. » patens, n. sp.
» 22. » ensiferum, n. sp.
» 23. » microscopicum, n. sp.
» 24. » fissum, n. sp. × 600.
» 25. » baculiferum, n. sp. × 600.
» 26. » nodiferum, n. sp. × 600.
» 27. » Sonthalianum, n. sp. × 400.
» 28. » ceratodes, n. sp.

TAB. XV.

» 1. Staurastrum sexangulare (BULNH.) LUND., var. γ crassum, n. v., formæ.
» 2. Staurastrum sexangulare (BULNH.) LUND., var. δ intermedium, n. v.
» 3. Staurastrum sexangulare, (BULNH.) LUND., var. ε attenuatum, n. v.
» 4. Staurastrum paradoxum, MEYEN; f. 2-gona, a b; f. 3-gona, d e; var. β longipes, NORDST., c f.
» 5. Staurastrum paradoxum, MEYEN; var. γ depressum, n. v.
» 6. Staurastrum stellinum, n. sp.
» 7. » sub-rotula, n. sp.
» 8. » bifidum, BREB., var. tortum, n. v. Cfr t. XVI, f. 37.
» 9. Staurastrum ordinatum, n. sp. (p. 108).
» 10. » trifidum, NORDST., f. reversa, n. f.
» 11. » laceratum, n. sp.
» 12. » resupinum, n. sp.
» 13. » senarium, EHR.
» 14. » nonanum, n. sp. Cfr f. 15, 24; t. XVI, f. 1.
» 15. Staurastrum nonanum, n. sp., f. minor.
» 16. » unicorne, n. sp.
» 17. » ecorne, n. sp.
» 18. » unguiferum, n. sp.
» 19. » » » f. β major.
» 20. » contectum, n. sp. Cfr t. XVI, f. 2; t. XXII, f. 11.
» 21. Staurastrum infestum, n. sp.
» 22. » sp.
» 23. » Hantzschii, REINSCH; var. β cornutum, n. v.

Fig. 24. Staurastrum nonanum, n. sp.; f. 4-gona.
25. Royii, n. sp.
26. » Wittrockii, n. sp.
27. » ineditum, n. sp.

TAB. XVI.

1. Staurastrum nonanum, n. sp., f. 4-gona, vert. v.
2. » contectum, n. sp., var. inevolutum, n. v. Cfr t. XV et XXII.
3. Staurastrum uncinatum, n. sp.
4. » punctulatum, BREB.
5. » Dickiei, RALFS; var. circulare, n. v. Cfr f. 25.
6. Staurastrum alternans, BREB. v. minus.
7. » apiculiferum, n. sp.
8. » Nathorstii, n. sp.
9. » curvatum, n. sp.
9* » bellum, n. sp.
10. » Manfeldtii, DELP.; var. γ pinnatum, n. v.
11. 12. Staurastrum Manfeldtii, DELP.; var. β bispinatum, n. v.
13. Staurastrum Burmense. NOB. (*S bifurcum* JOSH. ex p.)
14. Staurastrum pseudo-Sebaldi, WILLE; var. γ pulchellum, n. v. Cfr t. XIV, f. 14.
15. Staurastrum Lundellii, n. sp.
16. » recurvatum, n. sp.
17. » trisulcatum, n. sp.; f. minor. Cfr t. XVII, f. 7.
18. Staurastrum ambiguum, n. sp.
19. » quadricornutum, R. & B.
20. » mucronatum, RALFS; β. De Baryana, W. & N.
21. Staurastrum Maskellii, n. sp.
22. » ochthodes, n. sp.
23. » trachydermum, n. sp. Cfr f. 47.
24. » Japonicum (R. & B.) NOB.
25. » Dickiei, RALFS; var. circulare. f. major, n f.
26. Staurastrum Bissetii, n. sp.
27. » rusticum, n. sp.
28. » Zelleri, n. sp.
29. » megacanthum, LUND. var.
30. ignotum, n. sp., basal view.
31. » festivum, n. sp.
32. » aristiferum? RALFS.
33. Arthrodesmus morsus, n. sp.
34. Staurastrum Kurzianum, n. sp. vert. v. Cfr f. 43.
35. Staurastrum opimum, n. sp.
36. » denticulatum (NÄG.) ARCH., forma?
37. » bifidum, BREB., var. tortum; f. 4-gona. Cfr t. XV, f. 8.
38. Staurastrum conicum, n. sp. × 300.
39. » rotundatum, n. sp.
40. » orbiculare (EHR.) RALFS, × 900.
41. » bisulcatum, n. sp.
42. » mutabile, n. sp.
43. » Kurzianum, n. sp.

Fig. 44. Staurastrum cristatum (NÄG.) ARCH.; forma.
45. brevispinum, BREB.; f. Boldtii, n. f.
46. proboscideum (BREB.) ARCHER; var. β altum, BOLDT. Cfr t. XXI, f. 6.
47. Staurastrum trachydermum, n. sp., f. minor.
48. echinatum, BREB.

TAB. XVII.

1. Staurastrum Strensallense, n. sp. × 330.
2. gladiosum? TURNER, v. longispinum. (S. sagittiferum BÖRG.?)
3. Staurastrum Renardii, REINSCH.
4. quadricornutum, R. & B., f. divergens. n. f.
5. Staurastrum pseudo-furcigerum, REINSCH.
6. eximium, n. sp.
7. trisulcatum, n. sp. Cfr t. XVI, f. 17.
8. Staurastrum inerme, n. sp.
9. trifurcatum, n. sp., var. β reversum.
10. scolopacinum, n. sp.
11. Polyedrium sp.
12. Staurastrum curvirostrum, n. sp.
13. sociatum, WOLLE.
14. Onychonema uncinatum, WALLICH. a b, W. B. T. ad nat., × 500; c d e f g, after WALLICH Mscr. × circ. 600.
15. Onychonema læve, NORDST. α typica, 15 a; forma γ minus n. f., 15 b.
16. Onychonema uncinatum, forma β tenuis, n. f.
17. » Nordstedtianum, TURNER. a typica, a b; β compressum, n. v., c.
18. Sphærozosma vertebratum (BREB.) RALFS, var. Indicum. n. v.; a f. lata, a c d; b. f. subacuta, b.
19. Sphærozosma excavatum, RALFS. α typica, 19 c; β læve. RABH. 19 d; γ granulata RABH.? 19 a b c.
20. Sphærozosma filiforme (EHRB.) RALFS. a b × 500; c d × 1000.

TAB. XVIII.

1. Sphærozosma Wallichii, JACOBSEN.
2. Indicum, n. sp.
3. Spondylosium ovale, n. sp. Cfr f. 9.
4. » fragile, n. sp. a b × 500; c. × 1000.
5. Sphærozosma Bengalense, n. sp. a b × 350; c × 700.
6, 7. Spondylosium nitens (WALLICH) ARCHER. f. α major, f. 7; f. β minor, f. 6; formæ nov.
8. Spondylosium incurvatum, n. sp.
9. ovale (cellularum divisio). Cfr f. 3.
10, 11. Spondylosium nitens (ut supra), f. tensa.
12. Sphærozosma Wallichii. JACOBS. »Old separated joints» G. C. W.
13. Sphærozosma Wallichii, JACOBS.; lat. view.

Fig. 14. Spondylosium Mungulporeanum, n. sp.
15. Hyalotheca undulata NORDST., v. producta, n. v.; × circ. 700.
16. Sphærozosma exiguum, n. sp.
17. Spondylosium nitens (ut supra) var. γ triangulare; b. f. δ producta, n. f.
18. Streptonema trilobatum, WALLICH; a b, fronds in f. v.; c, cell-division; e, basal view; d, apical view; f, g, conjugation; h (also d), cells with parasitic epiphytes: a—c × 500; d—h, after G. C. W. × circ. 450.
19. Sphærozosma sp.
20. Spondylosium rectum, n. sp.

TAB. XIX.

1—3. Desmidium Bengalicum, n. sp. 1—3 a, W. B. T. ad nat; 3 b—f. after WALLICH Mscr.; g, cell cum endophyt.
4, 5. Desmidium Baileyi (RALFS) NORDST. 4, var. Wallichii, n. v.; 5, var. Indicum, n. v.
6. Spondylosium reniforme, n. sp.
7—8. Desmidium Swartzii, AGDH., var. c Brebissonii, KÜTZ.? fig. 8, fila copulantia, cum zygosporis, sec. G. C. W.
9—11. Desmidium Baileyi (RALFS) NORDST. 9, fila copulantia; 10, var. excavatum? (SCHAAR.) NOB.; 11, α typica, f. major.
12. Arthrodesmus spicatus, n. sp. × 400.
13. Cosmarium sparsum, n. sp., × 700, cfr seq.
14. Staurastrum dejectum, BREB., β apiculatum LUND. Cfr f. XX, f. 14.
15. Staurastrum mucronatum, RALFS, γ recta NOB., f. monstrosa.
16. Cosmarium sparsum, n. sp., × 700. Cell. copul. cum zygosp.
17. Micrasterias crux-melitensis (EHRB.) RALFS. vert. view.
18. Hyalotheca Indica, n. sp., α major. Cfr t. XXII, f. 17.

TAB. XX.

1, 2. Gonatozygon pilosum, WOLLE. f. 1, forma a minor; f. 2, forma b evoluta.
3. Gonatozygon reticulatum, n. sp.
4. » Ralfsii, DE BARY, f. δ depauperata, n. f.
5. Gonatozygon leiodermum, n. sp.
6. » Ralfsii, DE BARY, f. d crassa, n. f.
7. » Brebissonii, DE BARY, f. gracillima, n. f.
8. Cosmarium? sp. × 300.
9. Sorastrum? sp.; lat. view.
10. Tetrapedia? Wallichiana, n. sp. × 1000.
11. Cœlastrum Indicum, n. sp.
12. Pediastrum sp.; forma. ×?
13. » » » ×?
14. Staurastrum dejectum BREB., var. β apiculatum LUND., zygospore. Cfr t. XIX, f. 14.

Fig. 15. Polyedrium tetraedricum, NÄG. β torsum, n. f. × 600.
16. Pediastrum gracile, REINSCH, f. bidentata, n. f. × 700.
17. Pediastrum Sturmii, REINSCH, × 300.
18. Tetrapedia foliacea, n. sp. × 1000.
19. Scenedesmus quadricauda (TURP.) BREB.; formæ × 1000.
20. Staurophanum cruciatum (WALL.) NOB. f. minus, × 670
21. Staurophanum cruciatum (WALL.) NOB. f. majus, × 670.
22. Staurophanum pusillum (WALL.) NOB. × 400
23. Polyedrium bifidum, n. sp. × 1000.
24. » proteiforme, n. sp.; f. 2-3-gonæ.
25. Closteridium Bengalicum, n. sp. × 700.
26. Rhaphidium? spirale, n. sp. × 850.
27. Hydrocystis hydrophila, × 200; n. g. et sp.
28. Dictyosphærium reniforme? BULNH.
29. Sphærozyga Nordstedtii, n. sp. × 600.
30. Selenastrum acuminatum, LAGERH. × 650.
31. Thallodesmium Wallichianum, n. g. et sp. × 450.
32. Hydrocytium macrosporum, n. sp.; a × 500; b × 375.

Œdogonium sp. × 300?

TAB. XXI

1. Sphærozosma cosmarioides, WALLICH, × 750.
2. Spondylosium lamelliferum (CORDA) NOB., var. attenuatum, n. v., × 700.
3. Spondylosium? geminatum (WALL.) NOB.
4. » ? » » »
5. » ? » » » × 1000.
6. Staurastrum proboscideum (BREB.) ARCHER, β altum, BOLDT. vert. et bas. v.
7. Oocystis? brunnea, n. sp. × 600.
8. Olpidium Indicum, n. sp. × 300 ('lagena' × 600).
9. Desmidium Baileyi? RALFS; 2 cells with abnormal ends; 2-gona?
10. Eudorina? Wallichii, n. sp.
11. Coleochæte? sp.
12. Glœotænium Loitlesbergerianum, HANSG.
13. Polyedrium trigonum, NÄG.
14. Oocystis mammillata, n. sp., × 1500.
15. Selenastrum Bibraianum, REINSCH, × 400.
16. Spirulina turfosa, CRAMER × 1000.
17. Crucigenia rectangularis (NÄG.) NOB. × 750.
18. Cœlastrum distans, n. sp. × 1000.
19. Endophyte! × 350.
20. Œdogonium undulatum (BREB.) BRAUN; a × 300; b × 500.
21. Pediastrum incavatum, n. sp.

TAB. XXII.

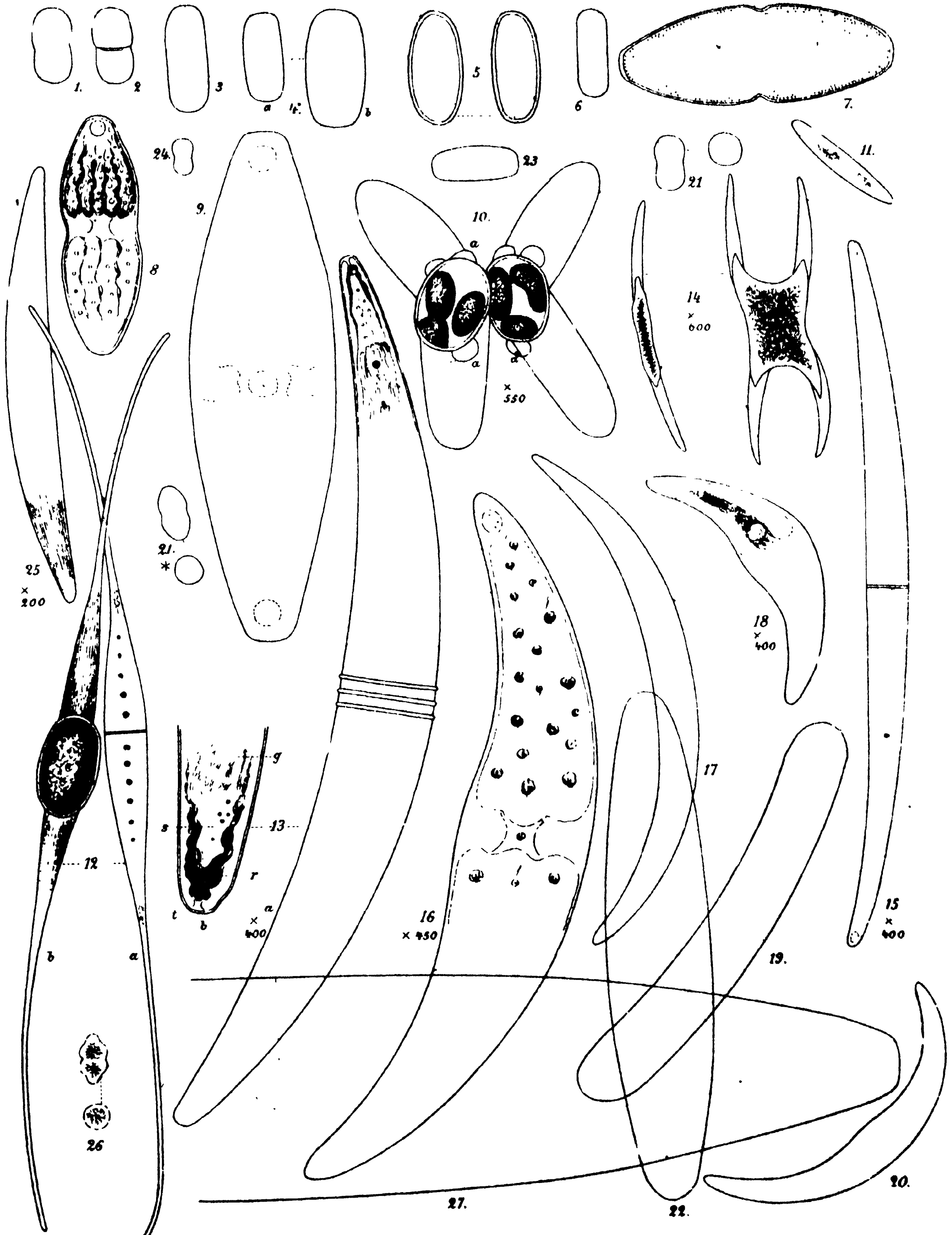
1. Micrasterias anomala, n. sp. a, α typica a fronte; b, a latere; c. var. β irregularis, n. v.

Fig. 2. **Micrasterias** lux, JOSH.; var. β Wallichii, n. v.
» 3. » apiculata (EHR.) MENGH.; var. **lacerata**, n. v.
» 4. **Euastrum** Webbianum, n. sp., f. minor.
» 5. **Dysphinctium** paxillosum, n. sp.
» 6. » **Lagerheimianum**, n. sp.
» 7. **Cosmarium** incavatum, n. sp.; var. β planum, n. v. Cfr t. VIII, f. 47.
» 8. **Xanthidium** torquatum, n. sp.
» 9. **Cosmarium** puteale, n. sp.; f. munita, n. f. Cfr t. VIII, f. 31.
» 10. **Xanthidium** eximium, n. sp., lat. view. Cfr t. XIII, f. 12.
» 11. **Staurastrum** contectum, n. sp. var. incvolutum.
» 12. » iotanum, WOLLE; f. 5-gona, n. f.
» 13. Closterium nematodes JOSH. β proboscideum T.
» 14. » truncatum, n. sp.?
» 15. » sub-crassum, n. sp.
» 16. Hyalotheca minima, n. sp.
» 17 » Indica, n. sp. α minor. Cfr t. XIX, f. 18.
» 18. Sphærozosma vinculatum, n. sp.

TAB. XXIII.

» 1. Micrasterias rotata f. evoluta, n. f. × 125
» 2. » Khasiæ, n. sp.
Fig. 3. **Penium spirostriolatum** BARK.; **Scottish typical forms.**
4. **Penium spirostriolatum** BARK.; **a Norwegian, b Swedish, specimen.**
5. **Penium spirostriolatum** BARK.; **American specimen.**
» 6. Penium Scandinavicum, **n. sp.**
» 7. » **Royanum**, n. **sp.**
» 8. Closterium **crassestriatum?** ARCH. **forma?** × 250.
» 9. **Euastrum** longicolle NORDST. var. **Himalayense**, n. v.
» 10. **Cosmarium sp.** (*Cos. Neapolitano* BALS. propius).
11. Cosmarium **sigillatum**, n. **sp.**
» 12. **Staurastrum longispinum** BAIL. **forma**, × 400.
» 13. Closterium **Leibleinii** KÜTZ. f. **parva**, **n.** f.
» 14. Cosmarium **craspedopleurum**, n. **sp.**
» 15. Spirotænia sp.

* * *



W. B T. delt. 1885

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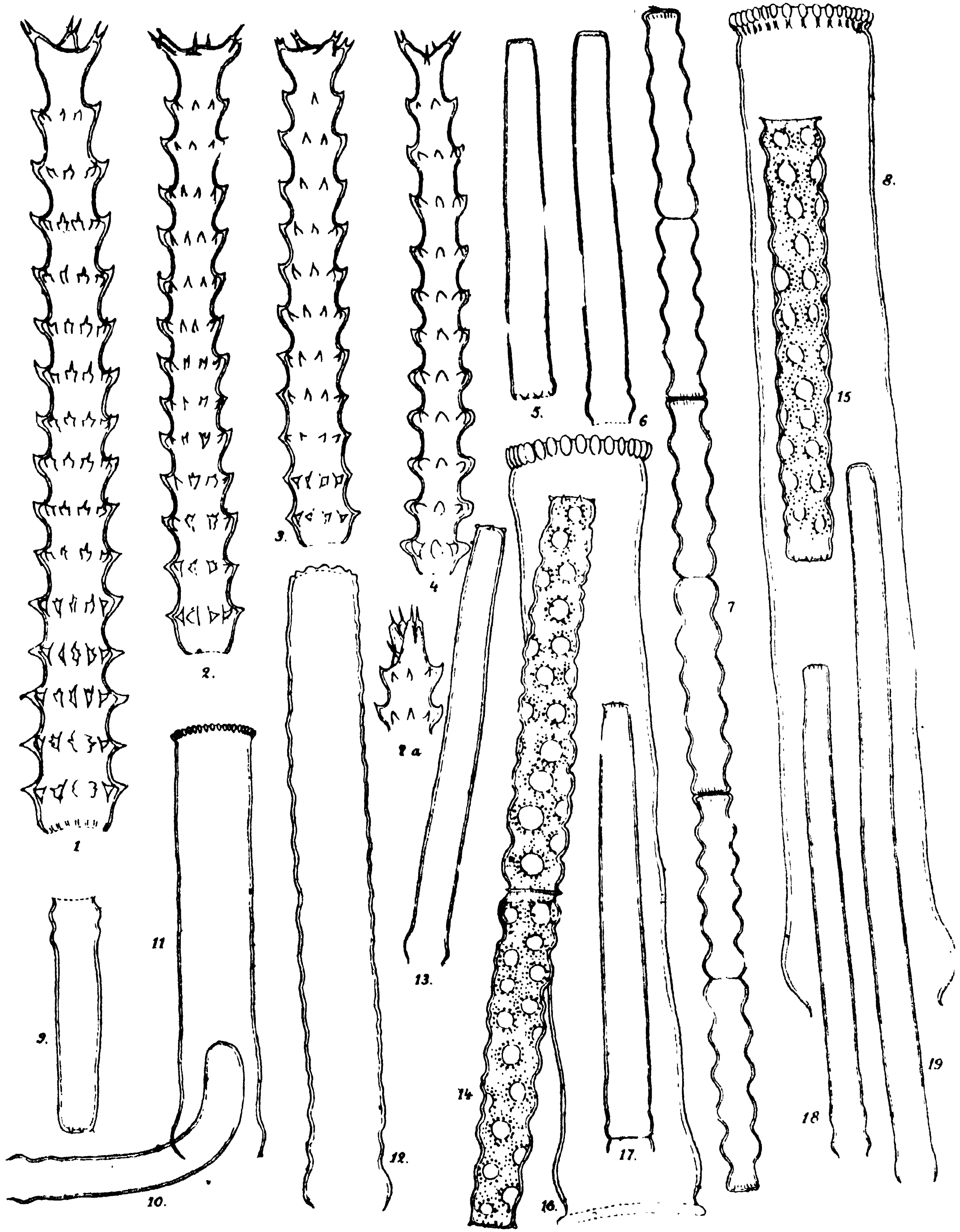
Tab II



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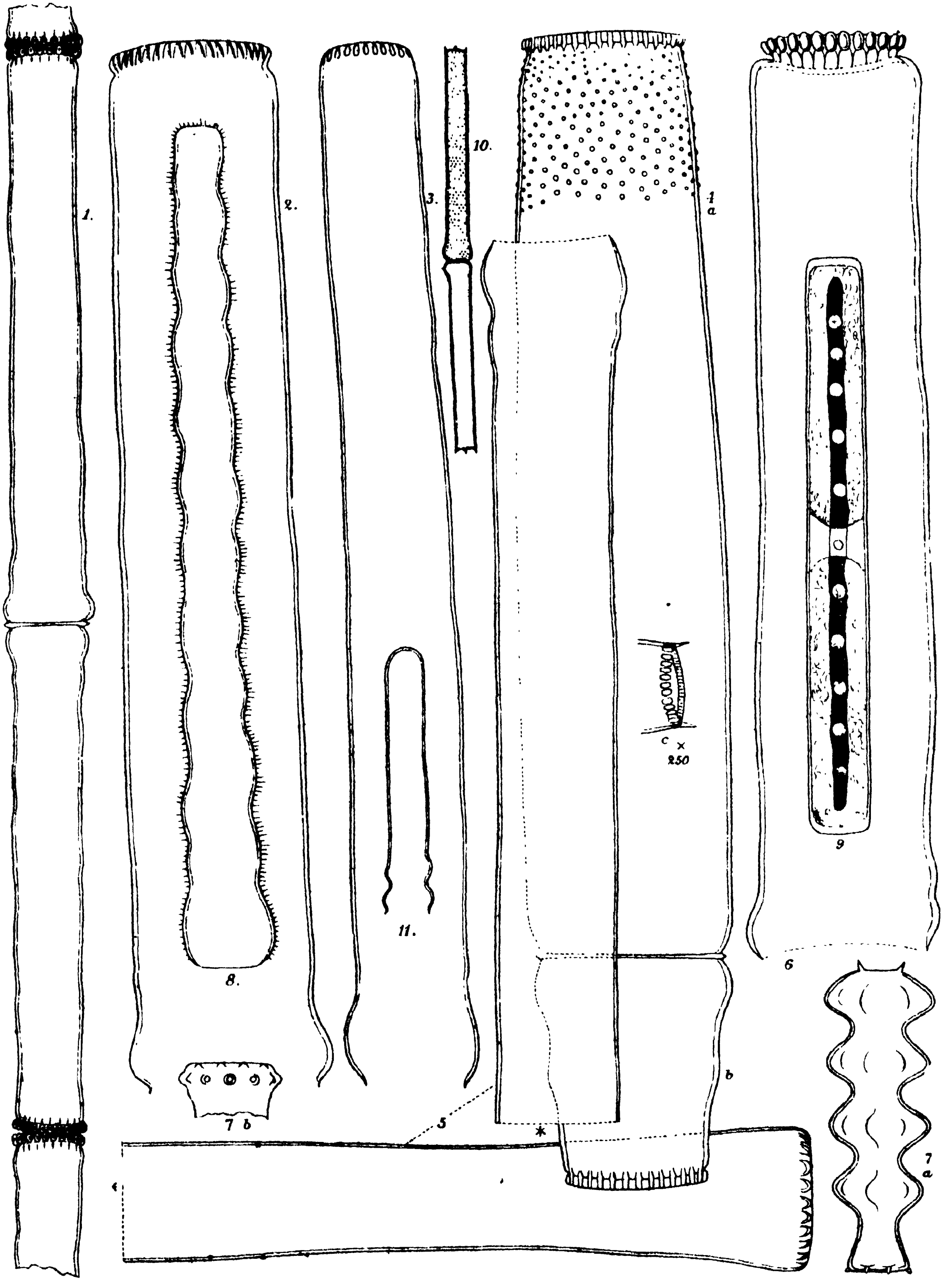

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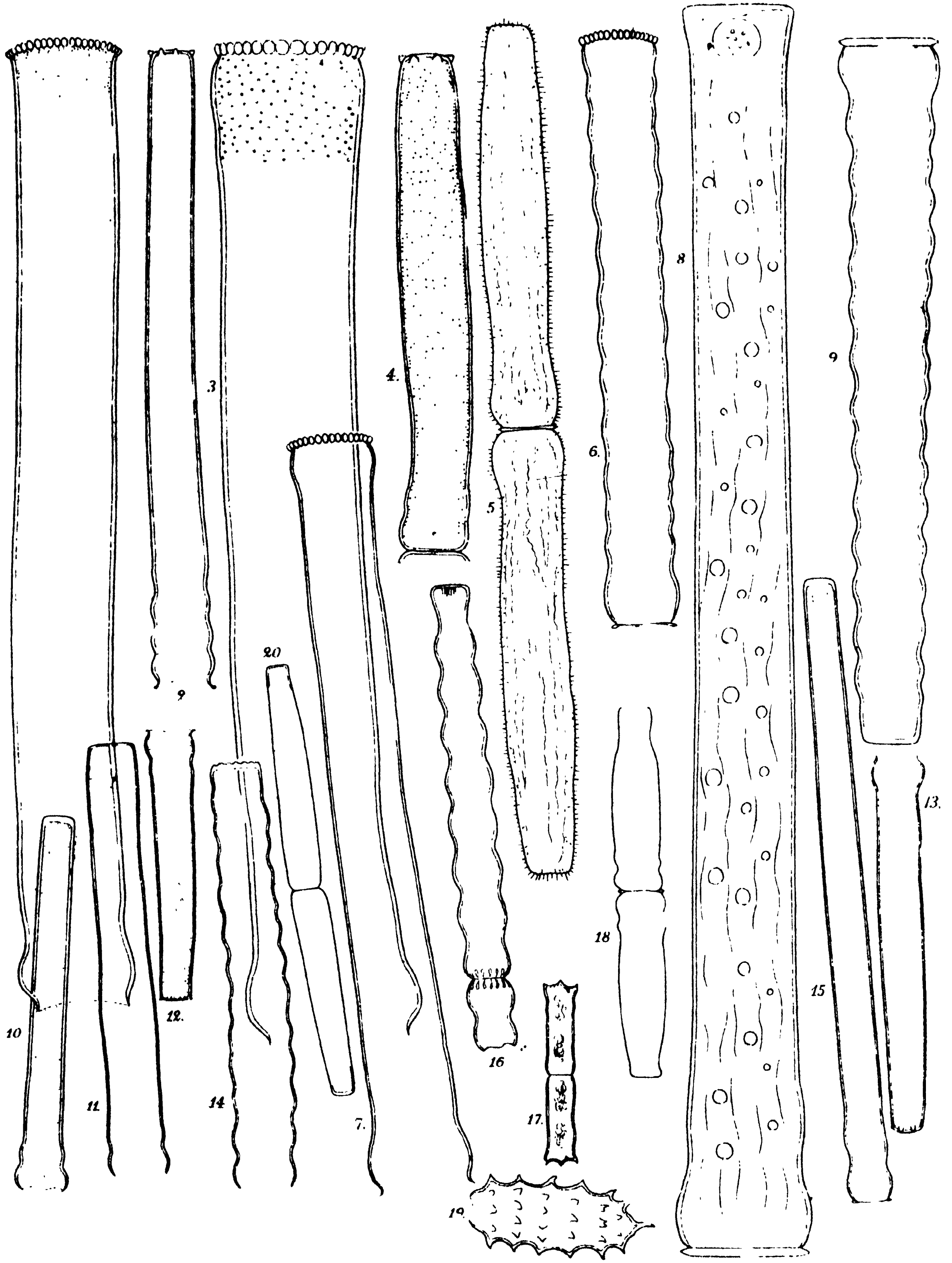

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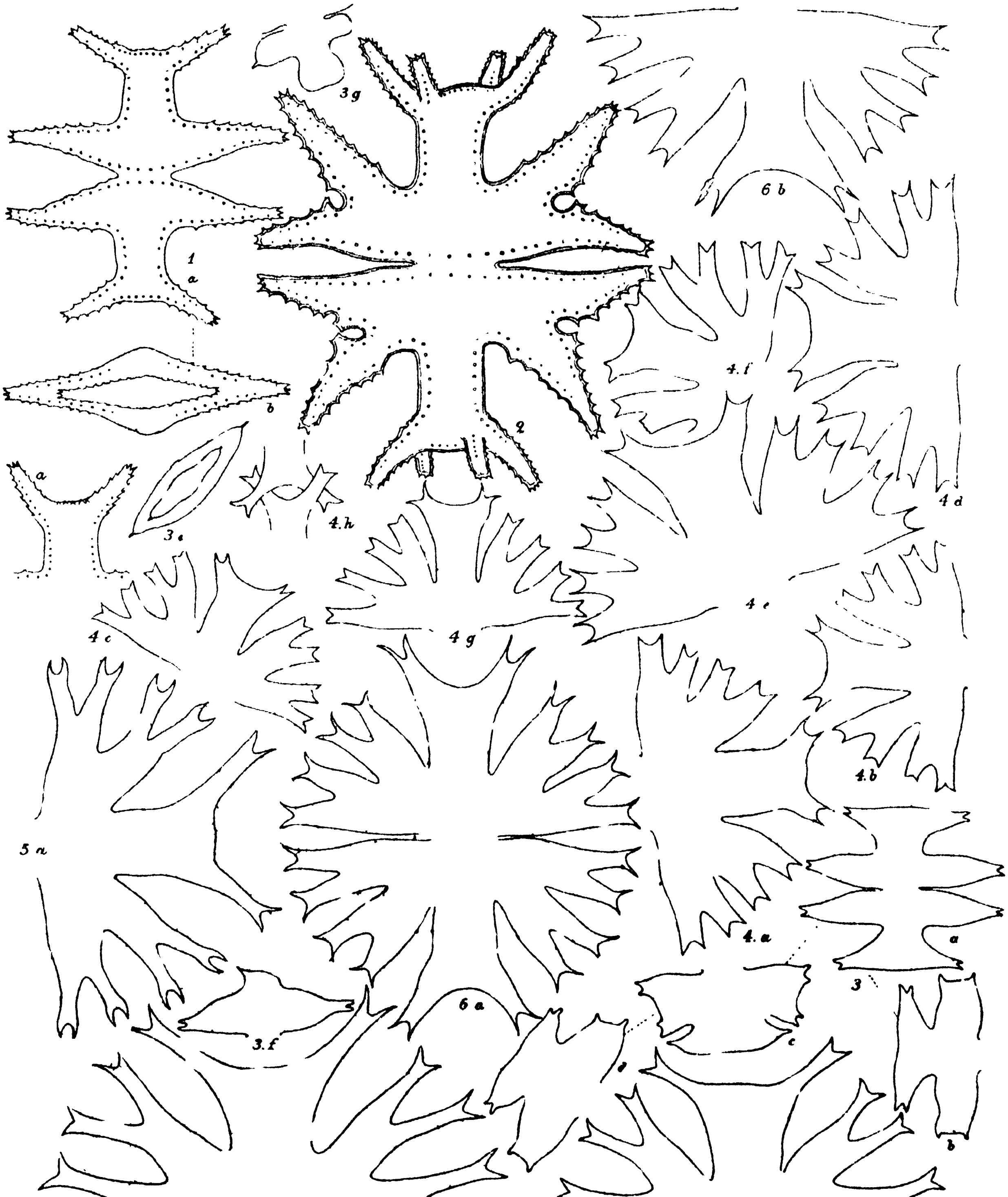

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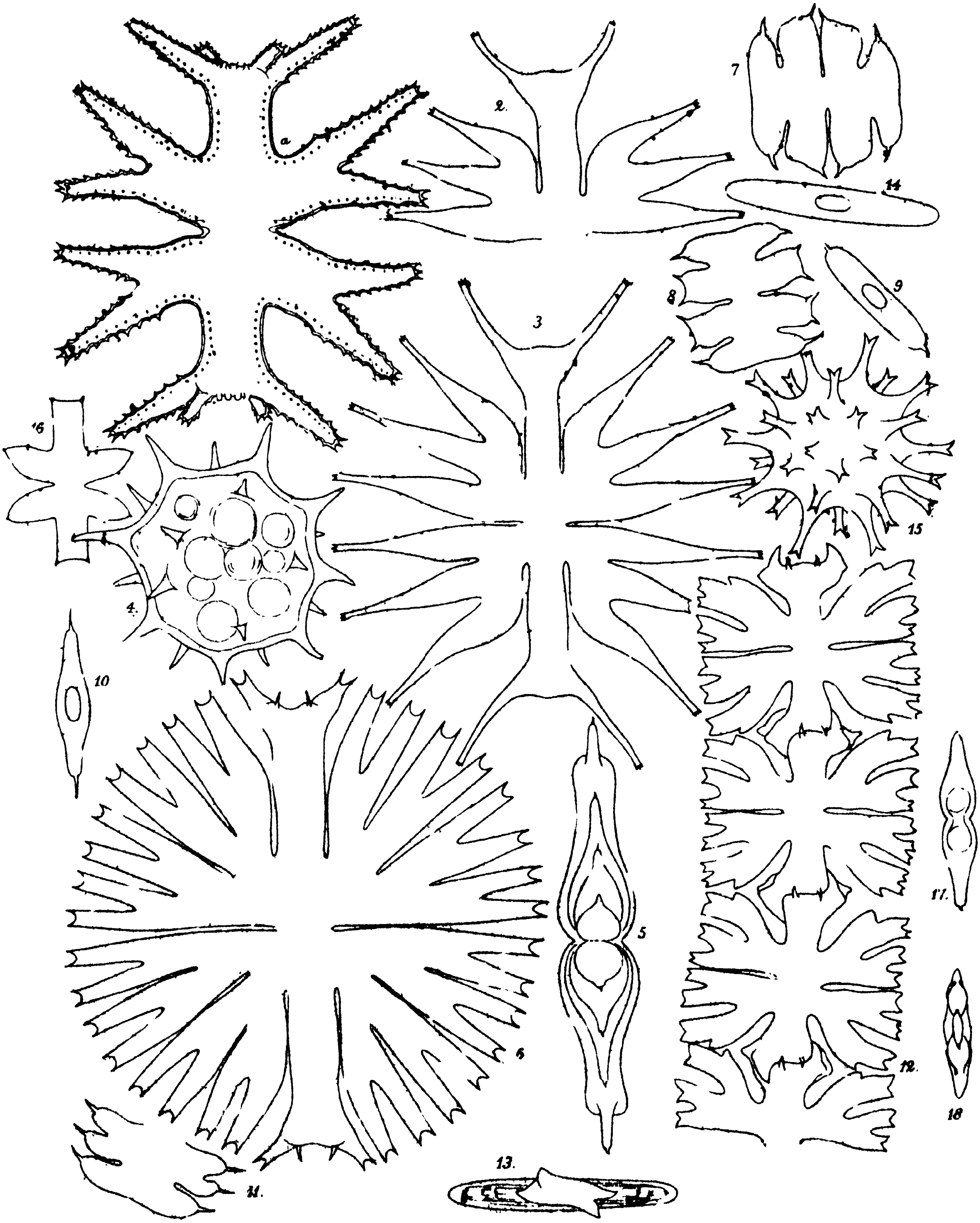
Tab VI



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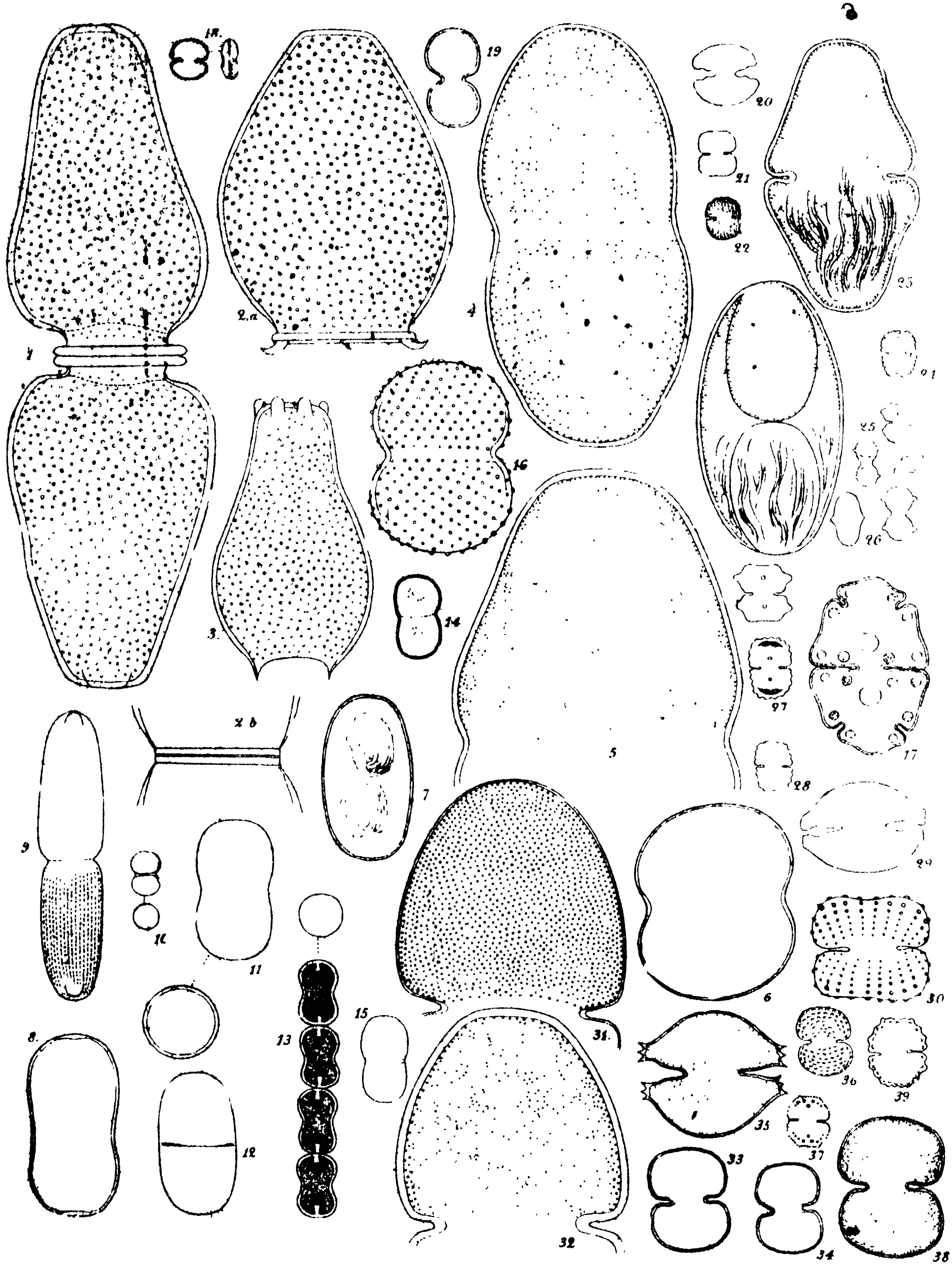

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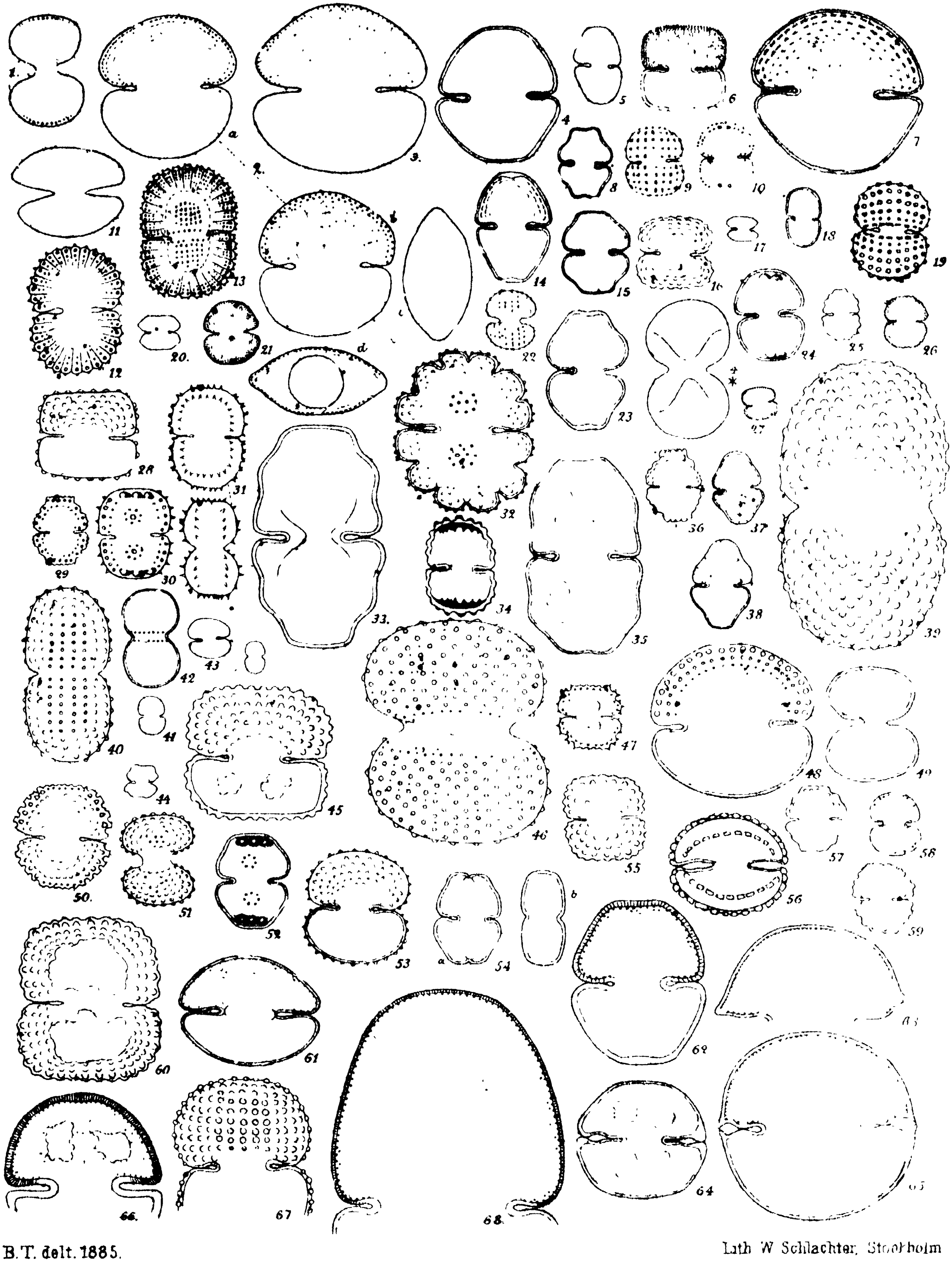

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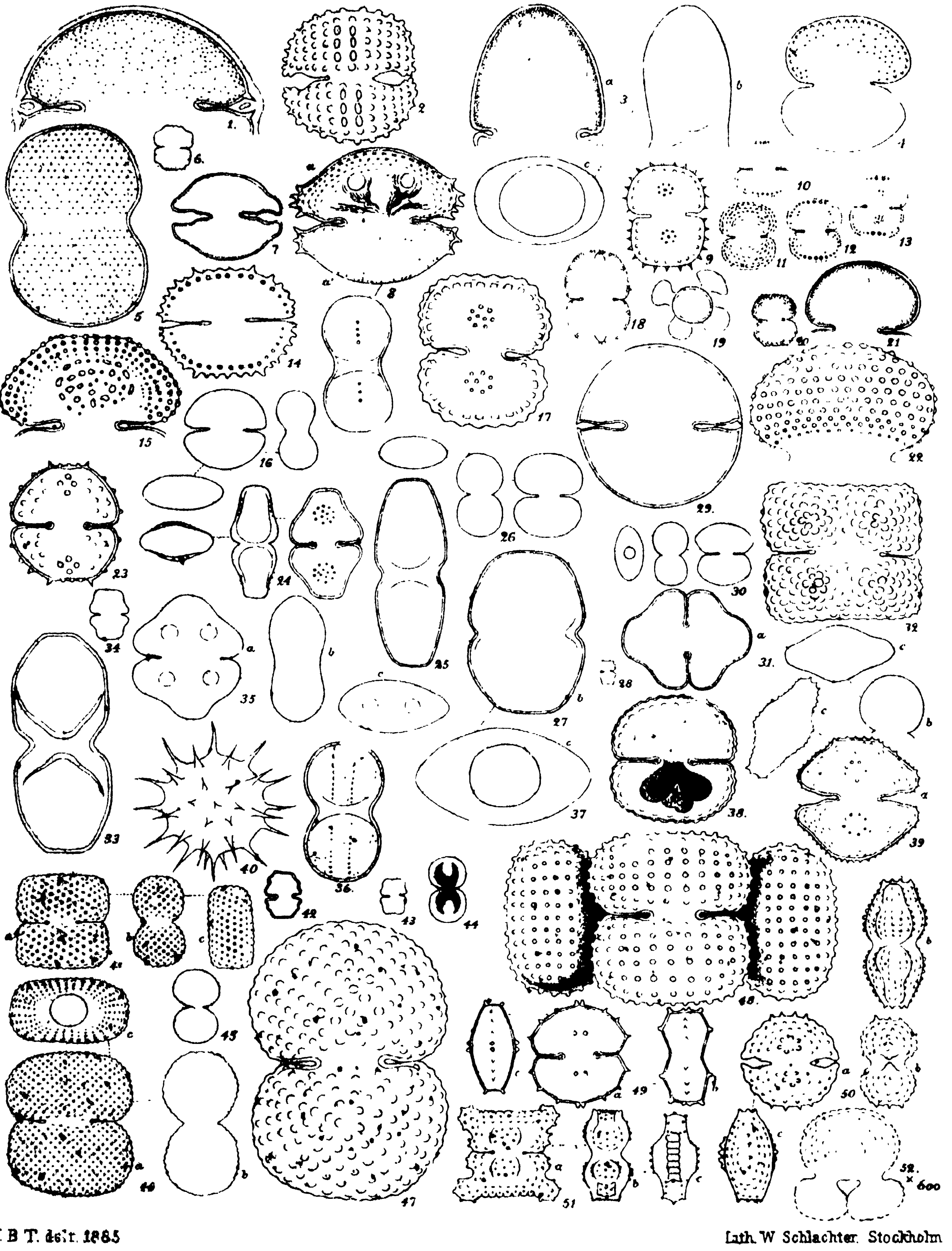

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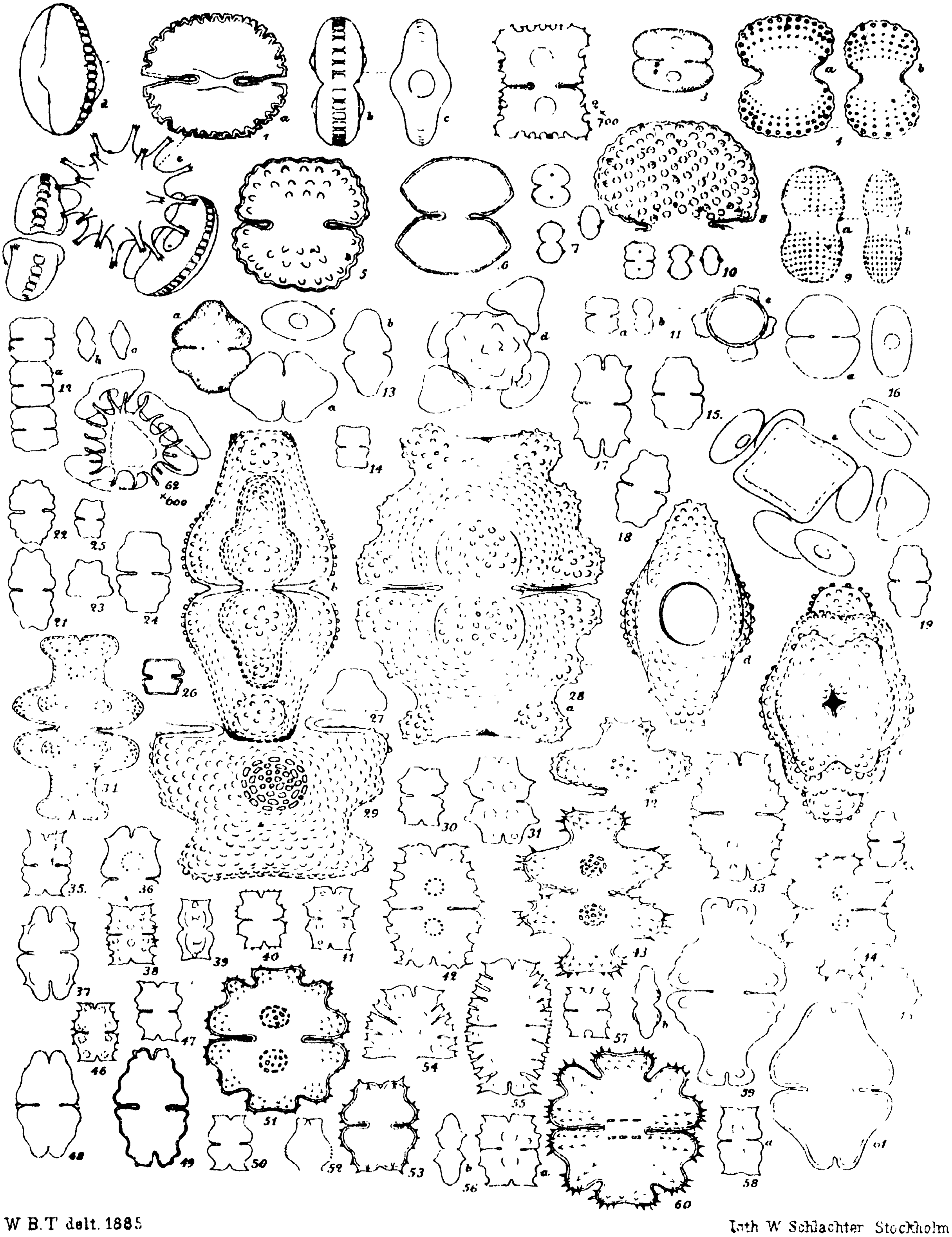

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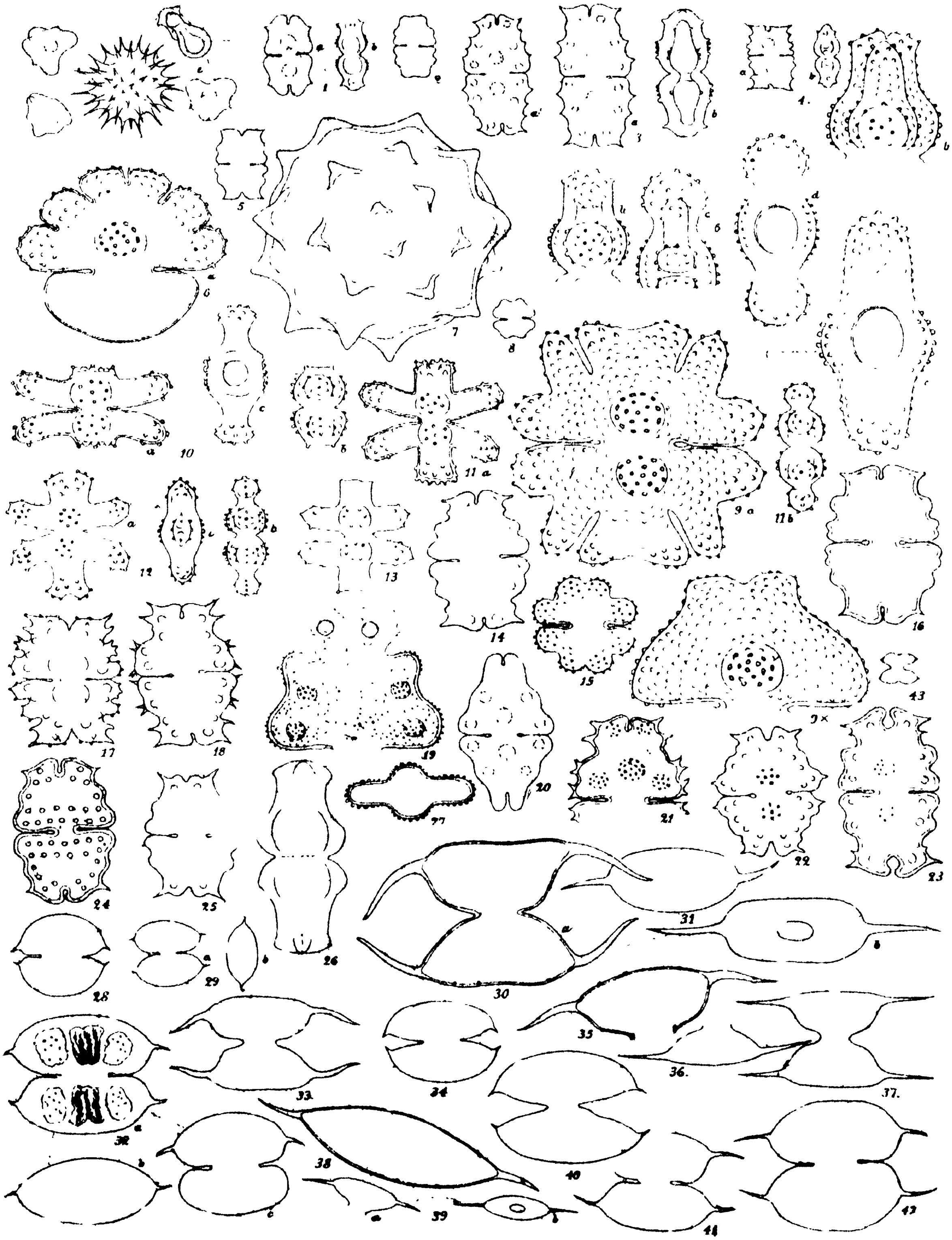
Tab XI



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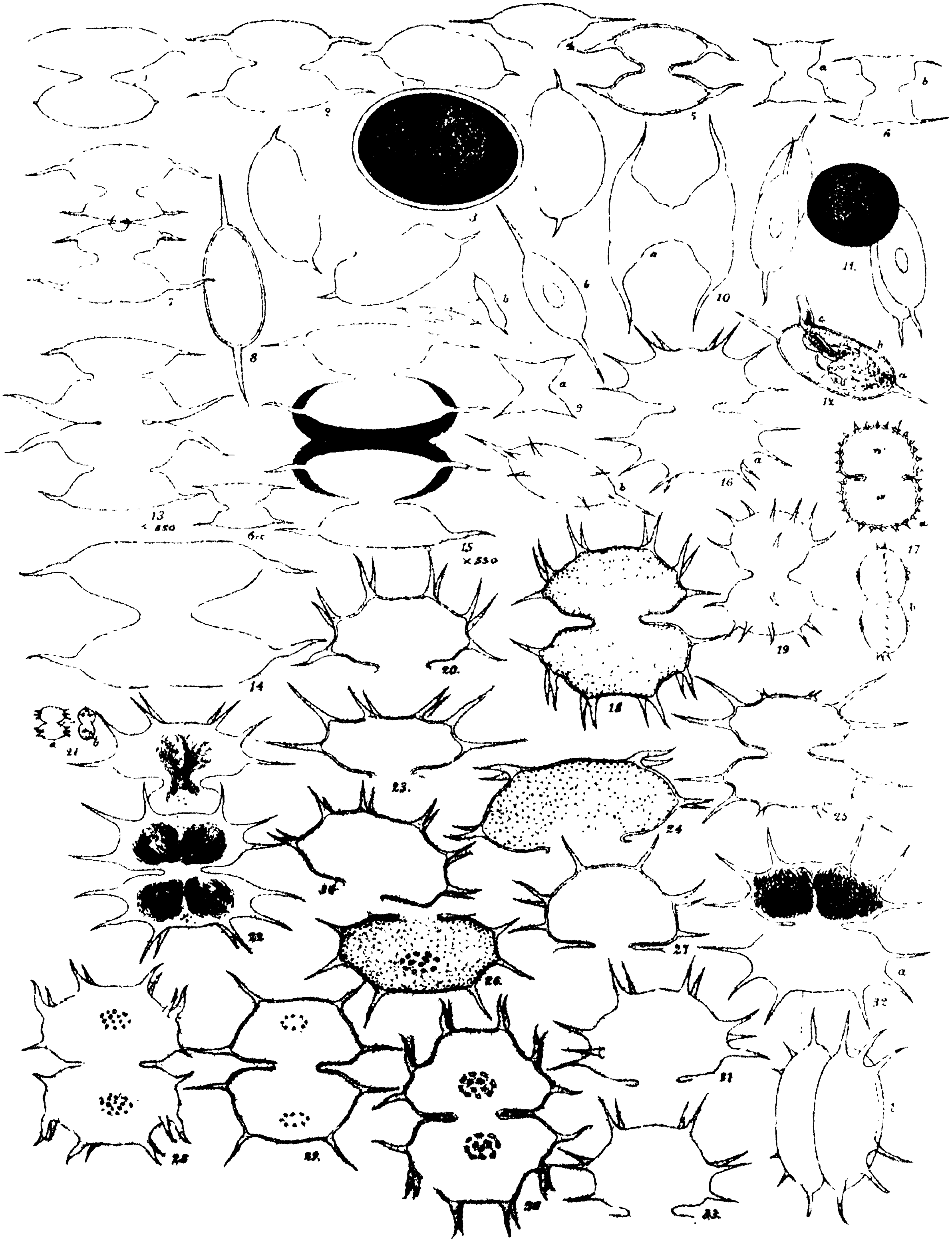

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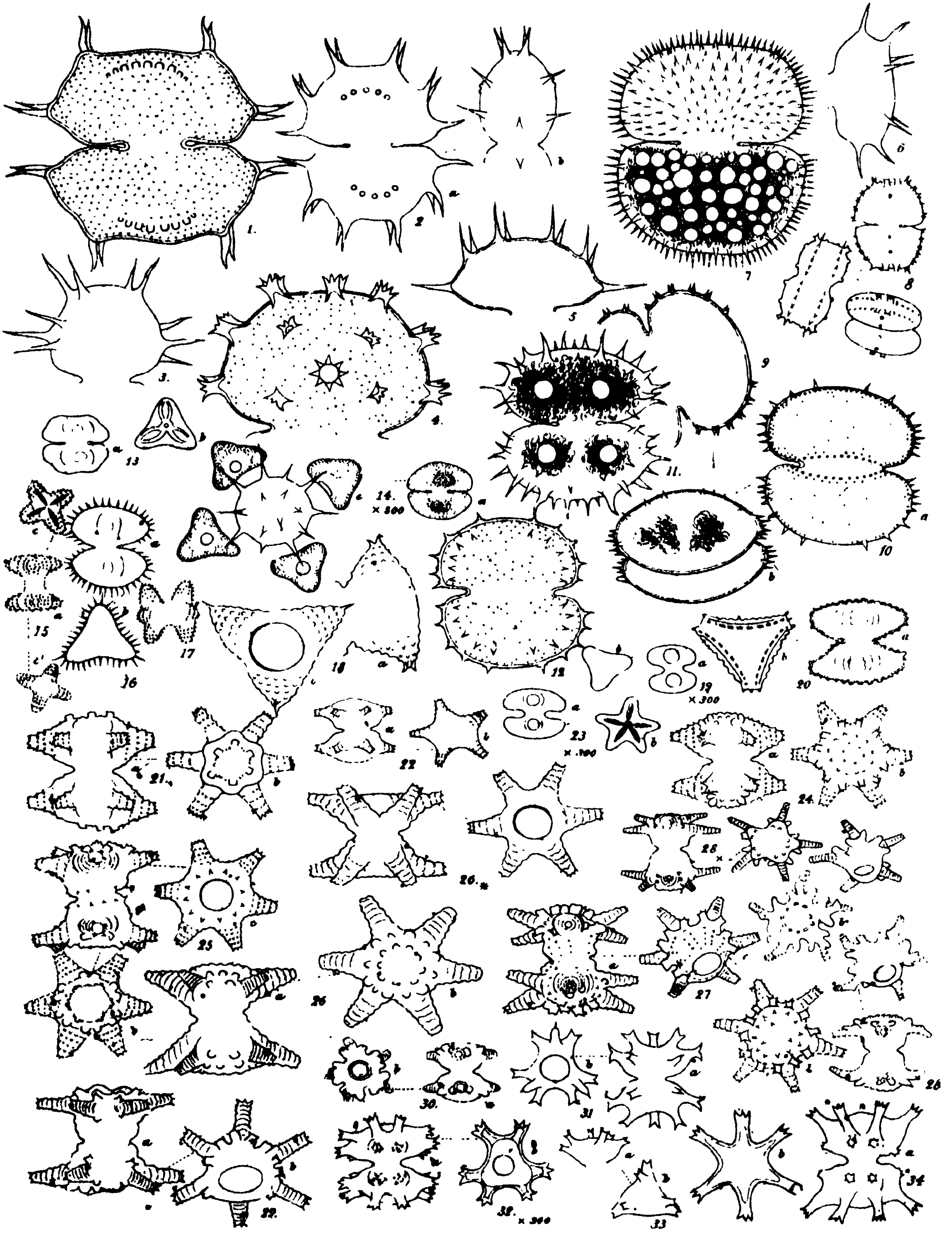

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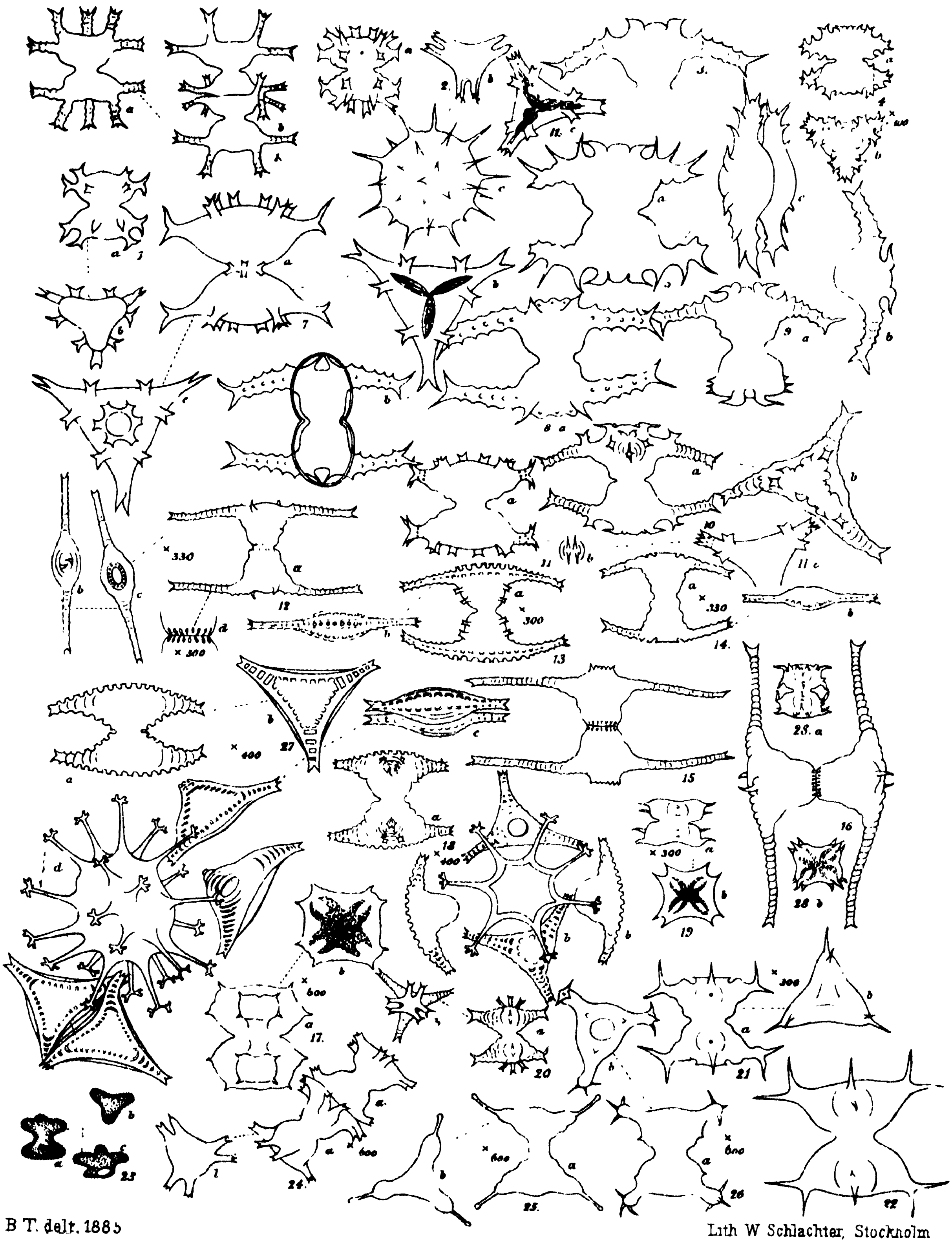

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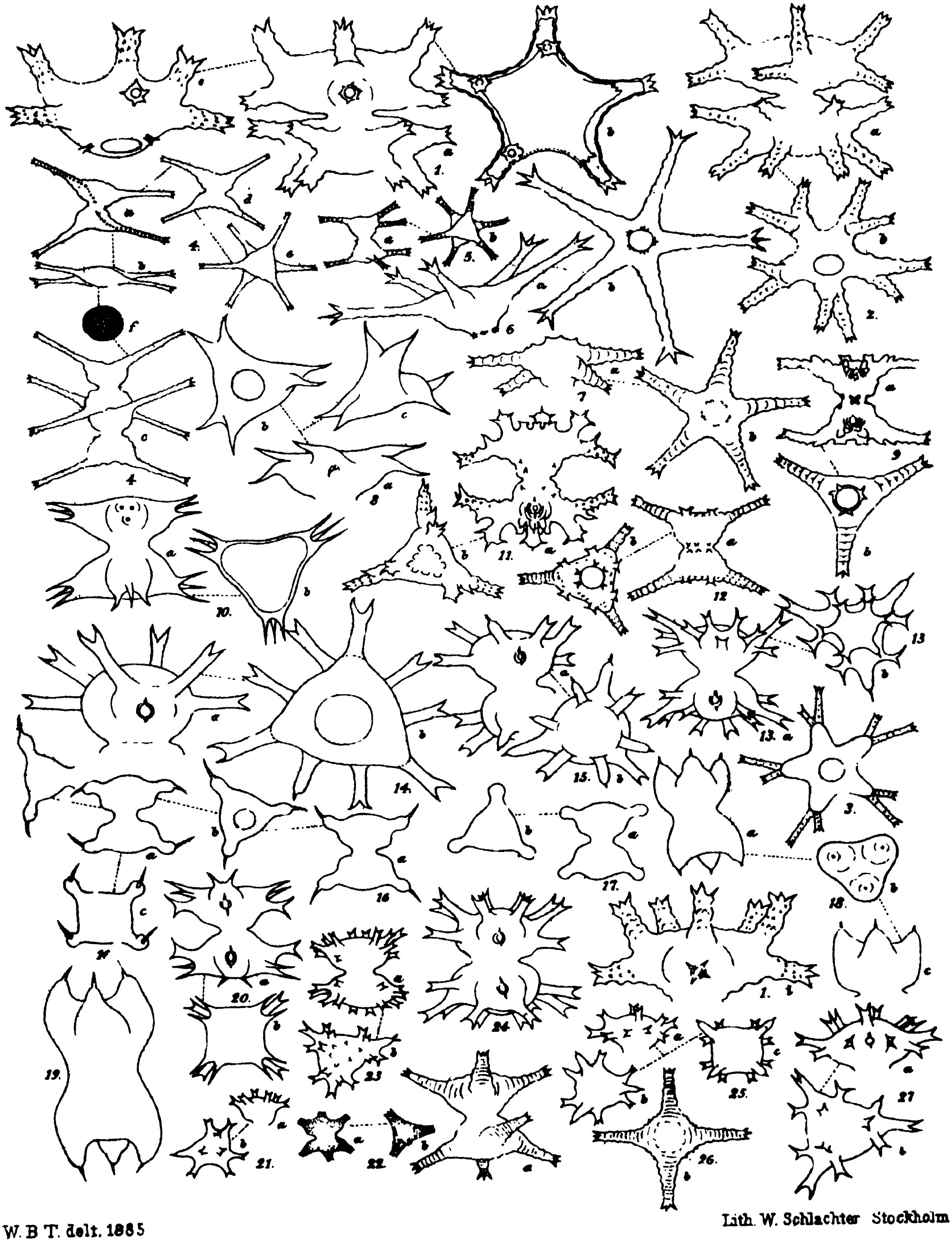

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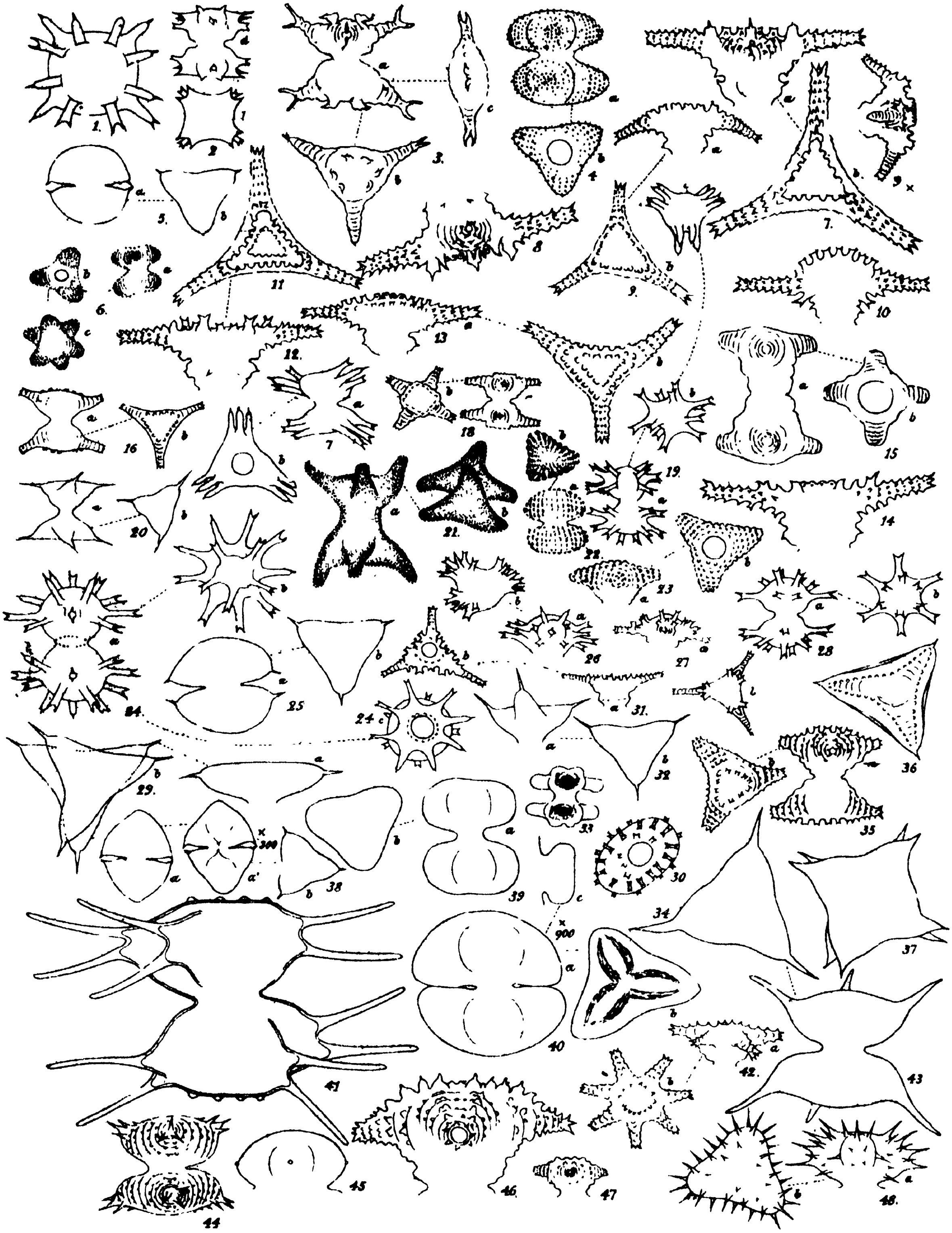

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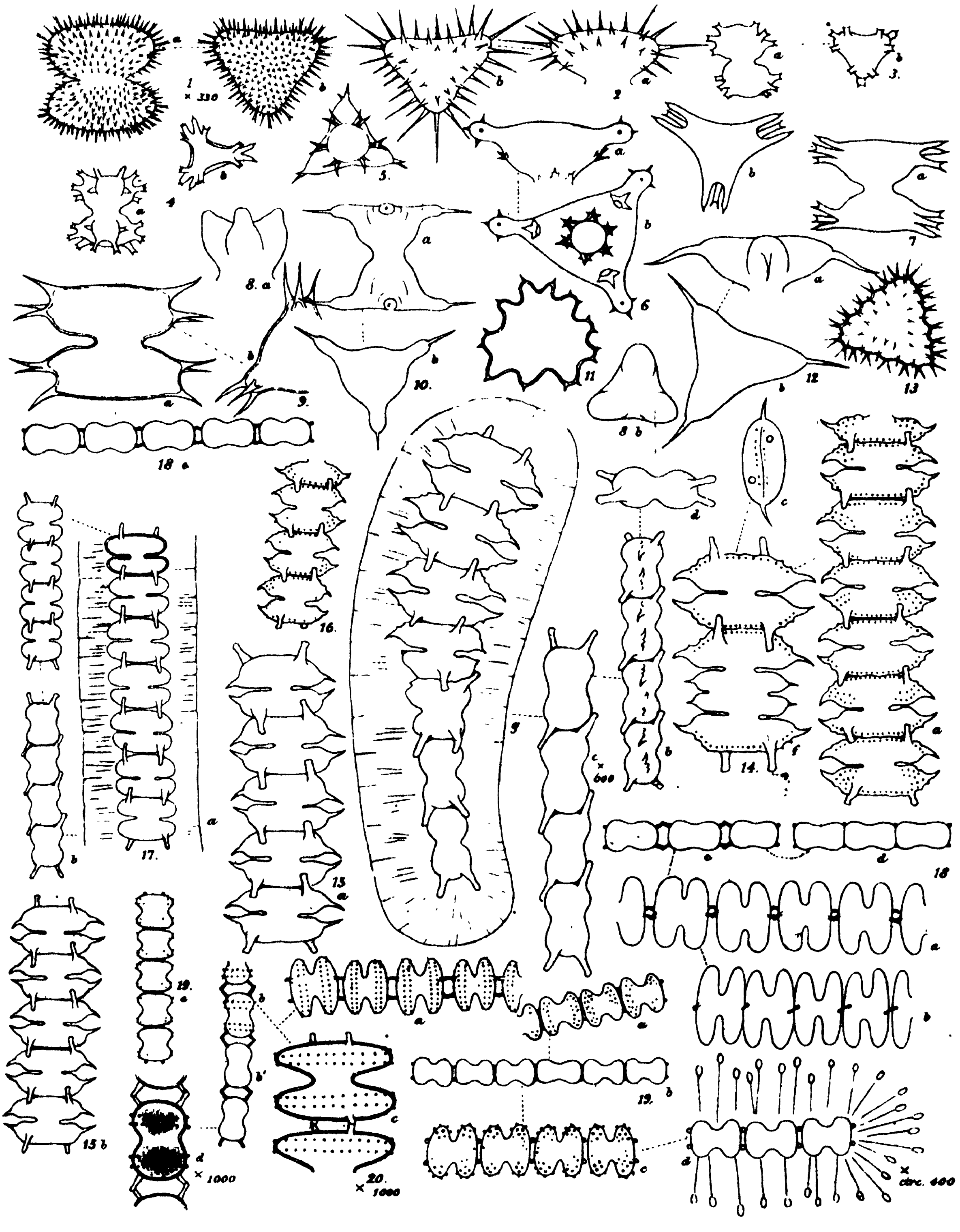

W B T. delt 1885

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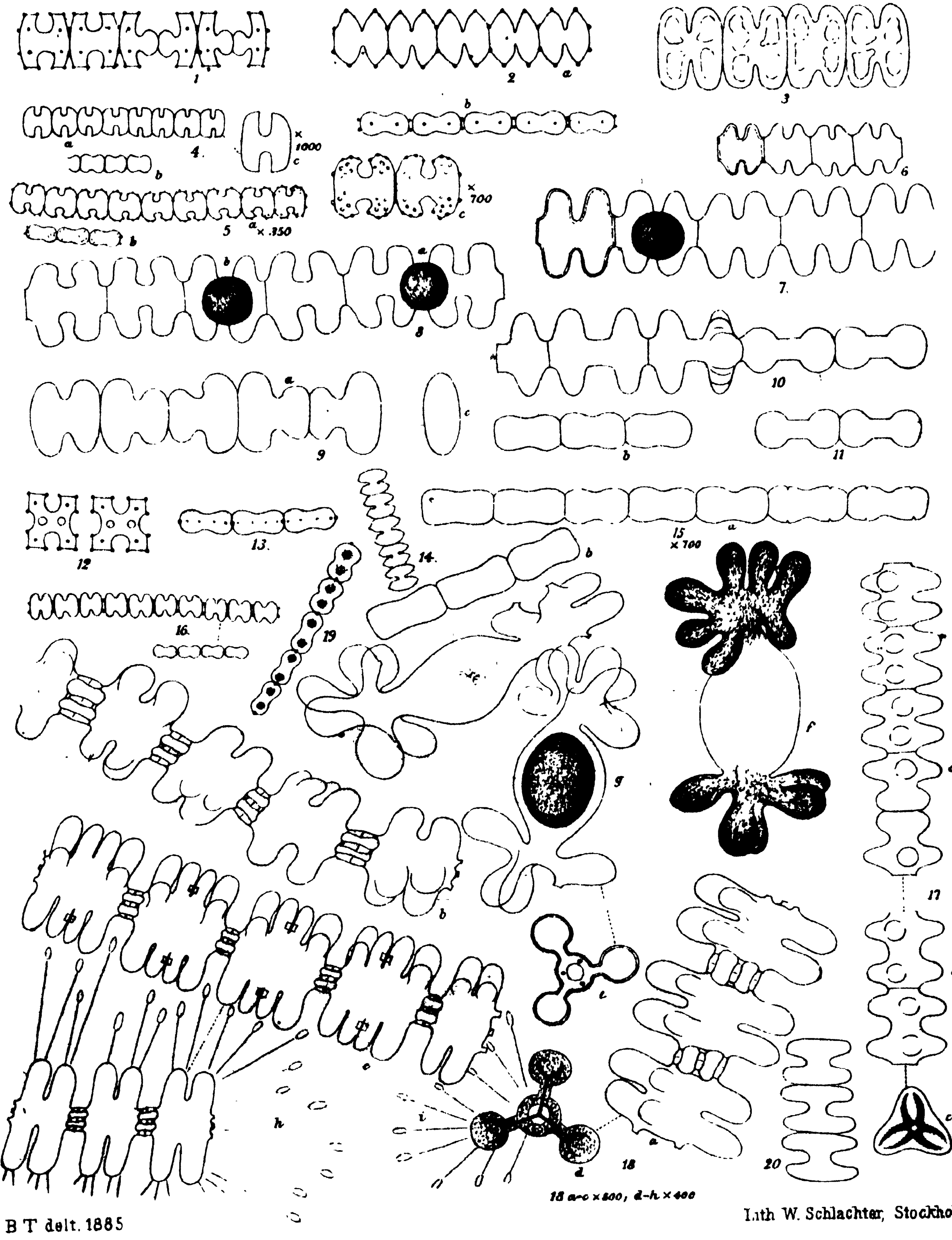

N. B T delt. 1885

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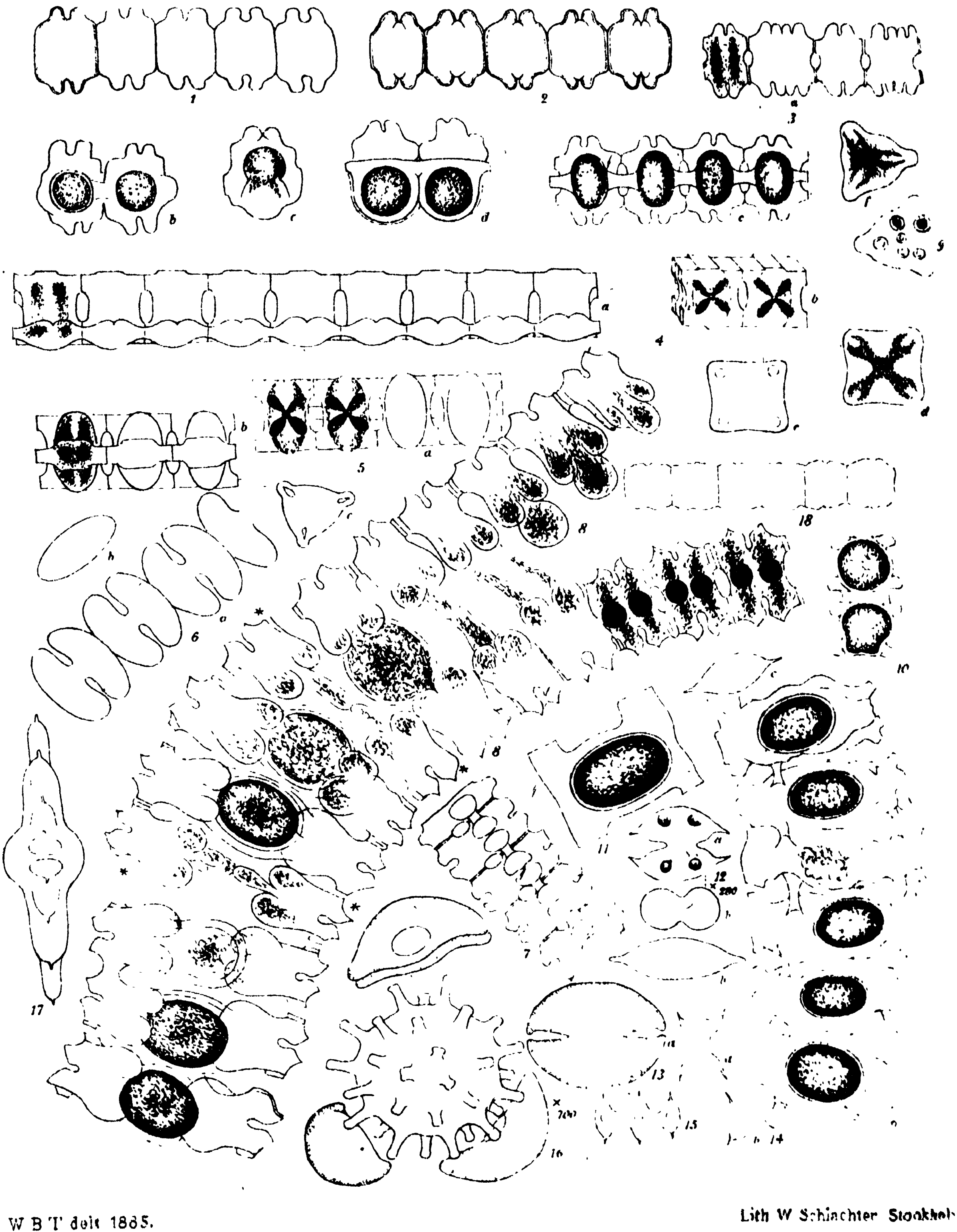
Tab XIX.



W B T. delt 1885.

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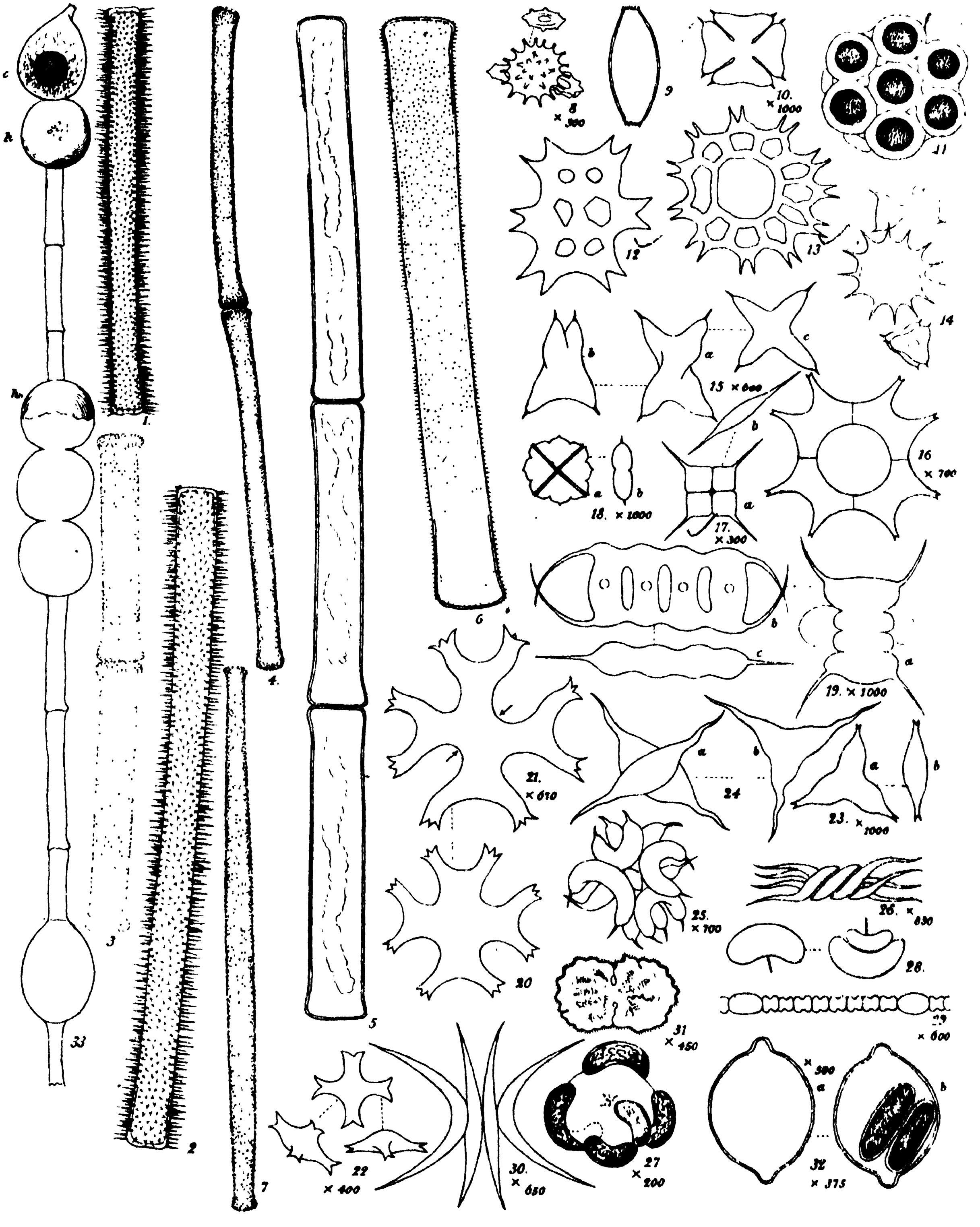

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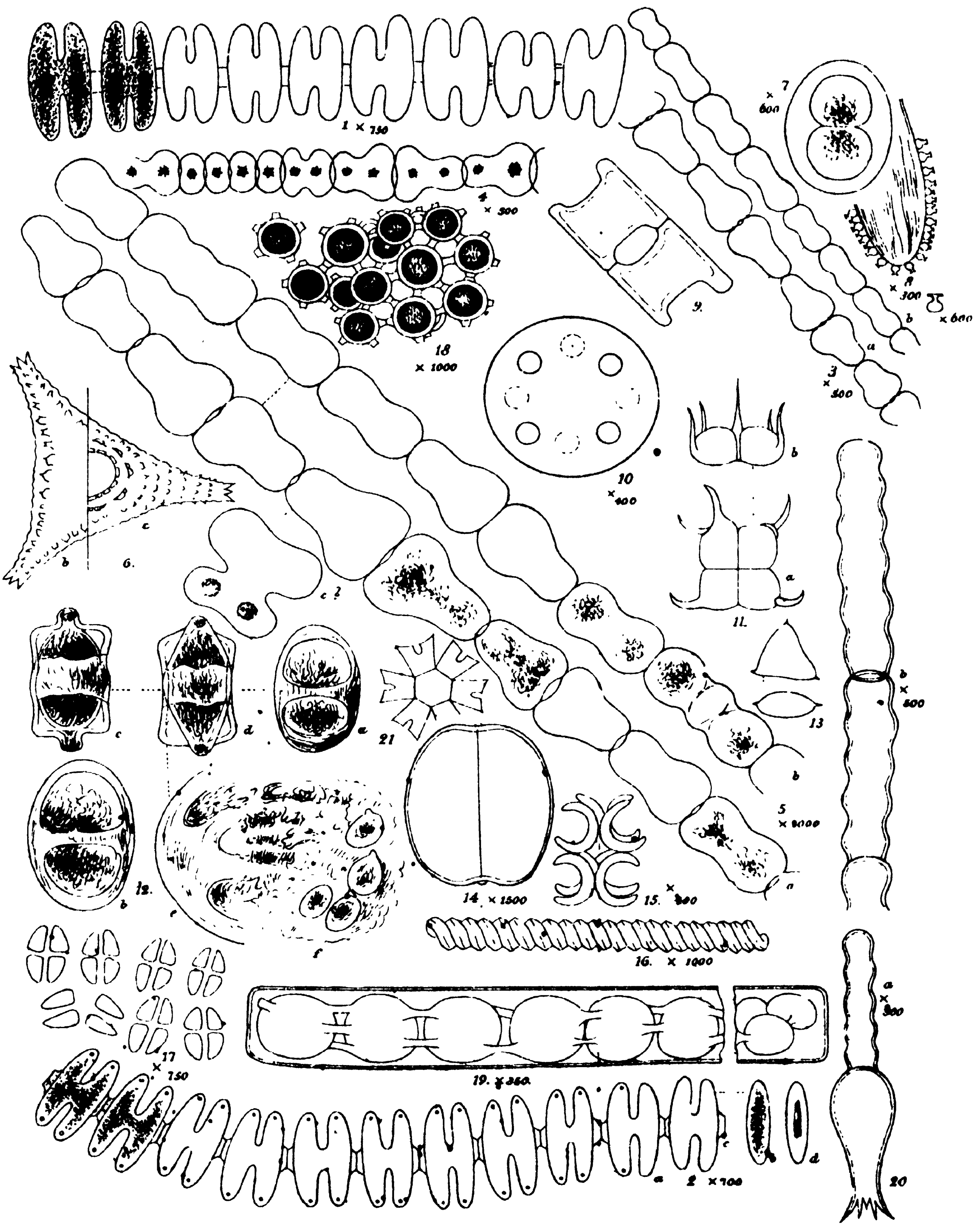

W. B T. delt. 1885

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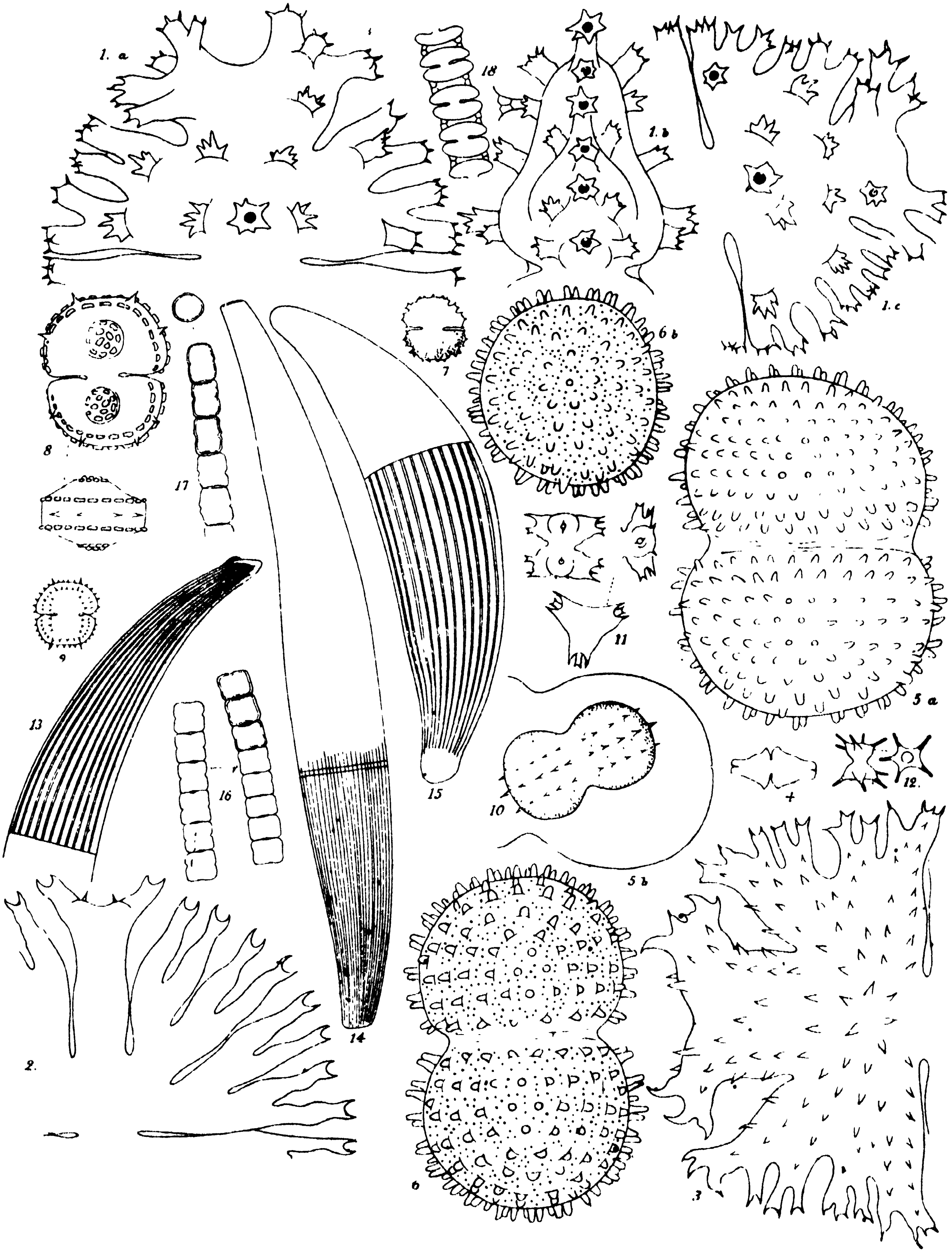
Tab. XXII.



W B T delt. 1889

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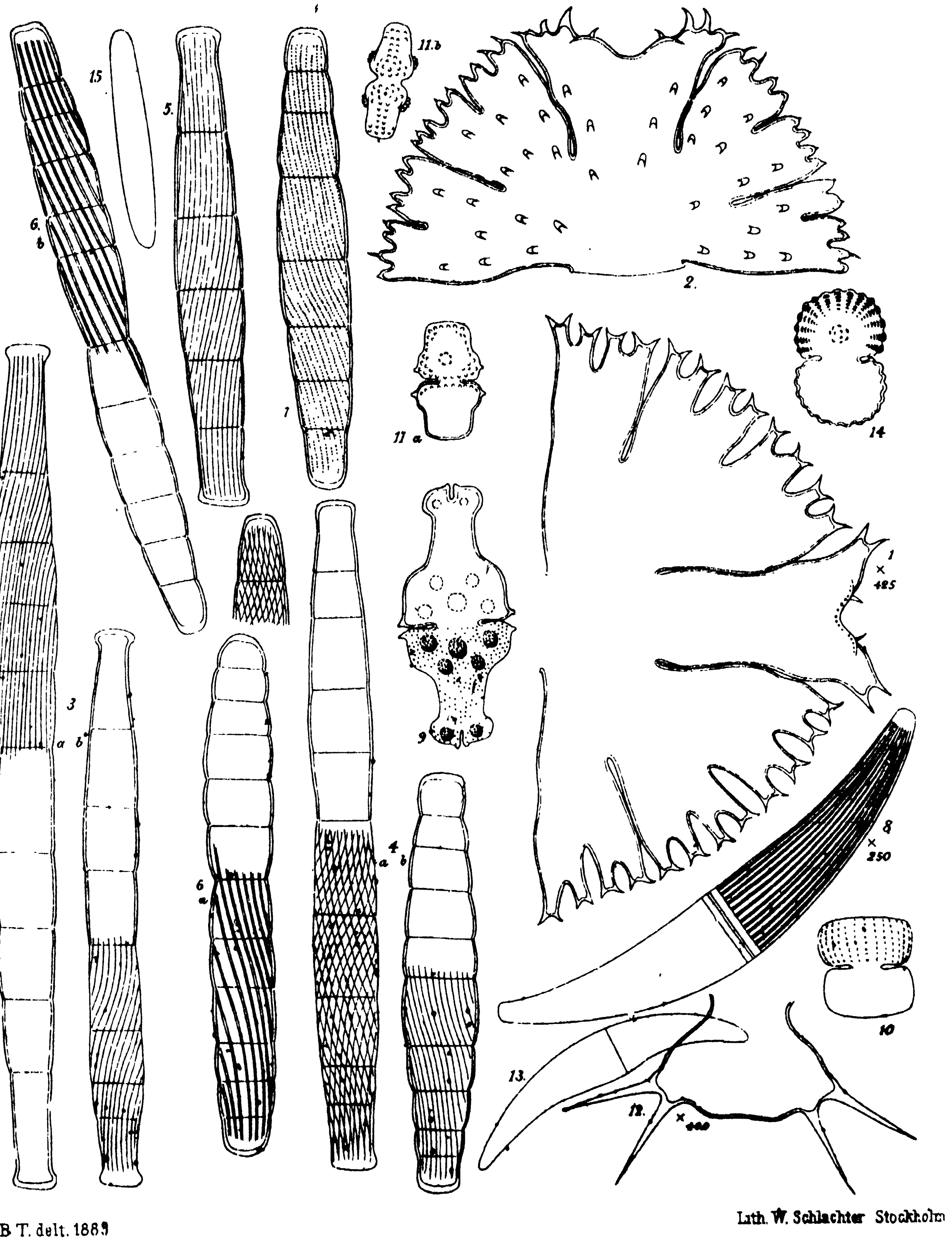

W. B T. delt. 1889

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